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An Earnest Jest.

SOME months ago THE ELECTRICAL WORLD contained a brief squib suggesting the use of electric lights to attract and destroy insects. The paragraph promptly went the rounds of the exchanges, gathering picturesque detail on the way, until it even turned up with a rich foreign flavor in idiomatic French. It was written more in jest than earnest; and we feel relieved at seeing that our humble suggestion has really been the subject of grave research by a learned entomologist, who estimates that the average insect mortality per night per arc light is in some localities about one hundred thousand. But alack! The ruthless hand of investigation has blasted our hopes by showing that the tuneful mosquito knows altogether too much to go for an arc lamp and will carry on his nefarious work in spite of the choicest resources of electrical science.

A Praiseworthy Exhibit.

THAT the suggestions recently made in our columns concerning the teaching of electricity in the public schools are capable of being adopted in actual practice is evident from the very notable work done by the boys in the Newark High School, of which a brief account is given on a following page. Prof. Sonn and Mr Hammer deserve great credit and the Newark pupils high praise, for the start they have made in the direction of educating electricians from their earliest years; and that the methods they have pursued are of real value is shown by the practical work already accomplished by members and graduates of the school. The man who began to understand the electric current at the age of twelve will have enormous advantages over his less favored brothers before he reaches the age of thirty. We shall look to see clever electricians developed from among the graduates of the Newark High School.

English and American.

WE publish this week an interesting paper by Mr. Bathurst on the difference between English and American engineering. Such comparisons cannot fail to teach a useful lesson, for it is highly improbable that all electrical wisdom is confined to either side of the Atlantic, and much can be learned from the successes as well as from the failures of others. It is especially noticeable that most of the differences described are due quite as much to changed conditions as to radically different habits of work. We may learn from our English friends much concerning substantial and finished work, perhaps, but we can teach them much about the prompt meeting of strange commercial conditions, the interchangeability of parts of apparatus, and rapid and efficient adaptability to sudden and unusual needs.

A Test of its Value.

DURING the past week the business people of New York and a large part of the United States have had to suffer a most embarrassing exemplification of the old proverb, "We never miss the water till the well runs dry." The value of the telegraph has not been fully appreciated by those who use it daily and hourly; and one salutary effect of the fire in the Western Union building, of which we speak more fully in another column, will be the increased respect given to the followers of Morse by those who have been wont to use and abuse them. The same old gentlemen who habitually lament the "good old times," when "bad news came by horse," were among those who displayed the most annoyance on Friday because their Chicago telegrams were a few hours late; and we trust that for the future nothing but blizzards will prevent their receiving the good and the bad news, alike in the twinkling of an eye.

The Electric Light Convention.

THE tenth meeting of the National Electric Light Association, to be held at Cape May, N. J., August 19, 20 and 21, promises to be as pleasant socially and as instructive to the members as any former convention of the association. The choice of Cape May as the place of meeting was a happy selection on the part of the committee. The beautiful surroundings and the cool sea breezes will prove very attractive at this season of the year, and, judging from present indications, the coming convention will be exceptionally well attended by representative electric light and power men. The Stockton Hotel, of which Mr. F. T. Walton is the proprietor, will be the headquarters of the association during the convention, and the best accommodations possible will be furnished to visiting members of the electrical fraternity. Each member who intends to be present at the coming convention should send early information of the fact to the hotel.

Dr. Fleming on Transformers.

IT is with great pleasure that we note the beginning of a new series of papers by this well-known authority in the London *Electrician*. His recent book on the subject is invaluable alike to the student and to the engineer, as a clear and beautiful treatment of alternating current phenomena; and now that he has entered upon the discussion of the more practical phases of the subject, we anticipate a splendid contribution to our knowledge of this most interesting branch of electrical engineering. The transformer system is notoriously difficult to investigate in popular terms, but we know of no who is more competent to put his mathematics into language that can be generally understood than Dr. Fleming, and his coming contributions cannot fail to be a valuable addition to electrical literature. We bring the first of Dr. Fleming's papers on the subject to the attention of our readers this week, as we feel that in the interest of electrical progress we owe it to those to whom our valued English contemporary is inaccessible.

Legislative Kindness.

THERE is a free and blithesome incongruity about the provisions of the remarkable tariff bill now under consideration that is thoroughly mediæval in its flavor. It more resembles the kind of duties levied some centuries ago by the merry barons who controlled the patronage of certain frowning private custom houses along the Rhine than the deliberate provisions of nineteenth century statesmen. Fortunately, in providing for more importunate industries, things electrical have been for the most part overlooked. We have already called attention to the duties on copper and on mica that are specially adapted to discourage electrical manufacturers, and it now remains to remind those of our friends who deal in electrical supplies that the duty on chromic acid has been raised, very considerably, from 15 to 50 per cent. Such thoughtful little attentions as these go far to endear their authors to us, and show us what an altogether lovely thing it is to stimulate industry by compelling it to hustle for such profits as may accidentally be permitted.

An Encouraging Report.

WE are glad to learn from a correspondent of the headway that domestic electric lighting has been making, especially around Philadelphia. We sincerely hope that detailed reports will come from some of these numerous small plants, for really the very thing which stands in the way of a more general use of electricity in country houses is not so much a question of practicability or of expense as it is a somewhat ill-founded fear of the amount of trouble and labor necessary. It is noticeable that none of the plants of which Mr. Stadelman speaks are operated by gas engines. In every case they are small steam plants, and are usually operated by the gardener or other servant about the place without necessitating the employment of a special engineer. That a steam engine with its attendant mechanical difficulties can be so successfully operated by untrained servants is certainly encouraging, and ought to stimulate the introduction of similar apparatus for lighting elsewhere. The gas engine, although much more easily operated than a steam engine, does not yet seem to have taken a firm grip in this country, and it is altogether probable that very many householders who would hardly care to entrust to their servants the care of a steam engine would find a gas motor thoroughly available for the purpose of electric lighting

Electric Cars.

OF making electric cars there is no end, and we show this week two new systems of traction that have recently been added to the already long list. One of them is the carefully worked out storage-battery motor car of the River and Rail Company; the other an elaborate conduit scheme that hails from Kansas. The ingenuity of inventors is being turned vigorously to the solution of that exasperating problem of dispensing with the trolley wire, and although success has been particularly elusive up to the present, we live in hope that some one of the new comers will merit and attain it. The River and Rail car seems well and thoughtfully designed, and is provided with an elaborate clutch device, permitting the motor to run free and start the car gradually without the excessive demand for current that is so objectionable. Means for varying the reduction ratio between armature and axle speeds are also provided. The conduit road referred to has a wheeled collecting device traveling in the subway, but otherwise has most of the merits and demerits of its class. The respective stumbling blocks of the storage battery and conduit systems have been excessive weight of battery on the one hand, and difficulty of insulation on the other, and until one or both of these difficulties is avoided or removed, electric railroading in large cities seems likely to go ahead more slowly than we should desire.

Schools of Electrical Engineering.

THE description of the course in electrical engineering at the College of New Jersey should be read with interest by all who appreciate the growing importance of technical education. The young man who enters upon the study of applied electricity to-day has advantages that even five years ago were quite unattainable. Time was when almost the only available mode of acquiring a knowledge of practical electricity was by tedious and one-sided experience in the work shops. Just so, many years ago, the only way of learning chemistry was in an apothecary's shop. That splendid work has been done by men educated under these adverse circumstances is well known to every one, but the student of to-day may congratulate himself that the times have changed. He can now acquire all the general principles of the theory and practice of electrical engineering without the hard experience of wasting much time over things that will be of no service to him in his future career; and although in active life he will have to learn many details that do not properly find place in a laboratory, he will do this with vastly greater rapidity, because of his thorough previous training. Just eight years ago Wöhler, the last of the apothecary chemists, ended his long and distinguished career, and while we sincerely wish fullness of years and honors for the brilliant and successful workshop electricians who have done the pioneer work of their great profession, their places will one day be taken by men trained in the laboratory, as that of the venerable chemist was by men like Hoffman and Baeyer and Fischer and Victor Meyer.

A Colossal Bluff.

IT will be remembered that when the electric light companies put in their bids for city lighting, and raised the price by reason of the extortionate subway rates, the Gas Commission gasped and His Honor held up his hands in horror. The bids were rejected in a spasm of virtuous indignation, and new ones called for. These have now been opened and in spite of the gloomy threats of going back to gas lighting, the price of electricity has not fallen. With one accord the companies insist on an increase of pay to meet the increased cost of service. The Gas Commission is now amusing itself by another frantic effort to scare the obdurate bidders into a reduction. It ought by this time to realize that its threat of gas darkness is simply a gigantic and rather stupid bluff only capable of producing merited contempt. The electric companies are perfectly able to do a profitable business without any city lighting whatever. A glance at the bids shows that the number of lamps bid for by any one company would be a very small factor in the output of its plant. The prosperity and life of five great stations does not at all depend on the existence of the 890 city lamps, and if Mayor and Commission think the game is in their own hands they have fallen into grievous error. On the contrary, it is perfectly clear that the suspension of city electric lighting will only have the effect of hastening a day of reckoning that will not be altogether agreeable. The public has rights that even Gas Commissioners are bound to respect, and aside from this certain captious persons may inquire into the relations of the gas companies with this frolicsome bluff, and make themselves otherwise altogether too inquisitive for comfort.

Moonlight Tables for August.

As promised in THE ELECTRICAL WORLD of June 28, we continue the publication of the moonlight tables arranged by Mr. A. W. Frund, Superintendent of the Vincennes Electric Light and Power Company. The advantages of the Frund tables have already been mentioned in our columns; and we need only now repeat our belief that by their adoption a considerable gain is made: over all-night lighting in economy, and over moonlight lighting in usefulness.

Schedule for August, 1890.

TABLE NO. 1. Standard Moonlight. Philadelphia System.

Date.	Light.	Date.	Extinguish
1	No light.	1	No light.
2	7:40 P. M.	2	9:55 P. M.
3	7.40	3	10:25
4	7:40	4	10:55
5	7:40	5	11:25
6	7:40	6	11:50
7	7:40	8	12:20 A. M.
8	7:40	9	12:55
9	7:40	10	1:30
10	7:30	11	2:15
11	7:30	12	3:00
12	7:30	13	4:10
13	7:30	14	4:10
14	7:30	15	4:10
15	7:30	16	4:10
16	7:30	17	4:25
17	7:20	18	4:15
18	7:20	19	4:15
19	7:20	20	4:15
20	8:30	21	4:15
21	8:55	22	4:15
22	9:25	23	4:15
23	10:05	24	4:20
24	10:50	25	4:20
25	11:45	26	4:20
26			
27	12:50 A. M.	27	4:20
28	No light.	28	No light.
29	No light.	29	No light.
30	No light.	30	No light.
31	7:00 P. M.	31	8:50 P. M.

Total hours lighting, 159.55.

TABLE NO. 2. Frund's New Moonlight System.

Date.	Light.	Date.	Exting.
1	7:40 P. M.	1	12:00 M.
2	7:40	2	12:00
3	7:40	3	12:00
4	7:40	4	12:00
5	7:40	5	12:00
6	7:40	6	12:00
7	7:40	8	12:20 A. M.
8	7:40	9	12:55
9	7:40	10	1:30
10	7:30	11	2:15
11	7:30	12	3.00
12	7:30	13	4:10
13	7:30	14	4:10
14	7:30	15	4:10
15	7:30	16	4:10
16	7:30	17	4:15
17	7:20	18	4:15
18	7:20	19	4:15
19	7:20	20	4:15
20	7:20	21	4:15
21	7:20	22	4:15
22	7:20	23	4:15
23	7:20	24	4:20
24	7:10	25	4:20
25	7:10	26	4:20
26	7:10	26	12:00 M.
27	7:10	27	12:00
28	7:10	28	12:00
29	7:10	29	12:00
30	7:10	30	12:00
31	7:00	31	12:00

Total hours lighting, 209.25.

NEW BOOKS.

EXPERIMENTAL ELECTRICITY. By Edward Trevert. 164 pp.; 85 illustrations. Bubier Publishing Company, Lynn, Mass., 1890. Price $1.

This is a little book which is specially fitted for the combined amusement and information of the amateur who is possessed of some facility in mechanical operations. It contains instructions for some of the simple experiments in electricity and complete working directions for making a large number of pieces of minor electrical apparatus, beginning with so simple a thing as a voltaic cell and ending up with a very neat form of dynamo. Any one with a little facility at handling tools and a small workshop at hand can derive considerable entertainment and learn a great many things about electricity by following out the very complete working directions which Mr. Trevert gives. The book makes no pretensions to being a treatise on electricity, and gives comparatively little instruction outside of working directions, but for the class of amateur electricians for which it is designed it is really well adapted.

A POPULAR TREATISE ON THE ELECTRIC RAILWAY. By H. B. Prindle. 56 pp.; 38 illustrations. E. B. Stillings & Co., Boston, Mass. Price 50 cents.

A little pamphlet not attempting to go into details of the theory and practice of electric railroading, but which, nevertheless, gives a pretty good idea of the general arrangement of the apparatus, and the different forms of machinery now in general use. The general method of construction followed is given very clearly and definitely, and the cuts of apparatus are well selected. To any one who wants a clear though rudimentary idea of the electric railroad and railroad construction, Mr. Prindle's little book cannot fail to be of service and interest.

Fire at the Heart of a Great System.

On Friday, July 19, at about seven o'clock in the morning the odor of smoking gutta percha alarmed the operators on the sixth floor of the great Western Union building, at the corner of Broadway and Dey street, in this city. Two hours later everything combustible on the upper floors of the building had disappeared, and a fire comparatively diminutive in extent had crippled one of the telegraph systems of the country.

No more remarkable fire has ever broken out, none has ever attracted more attention; and never before, since the days of Morse, has the world been so imperatively called upon to realize the importance of the electric telegraph. Probably not a hundred people outside of telegraph circles had ever thought of the far-reaching, transcendent influence of that little room, perhaps 60 feet square, in which were centered the wires that furnish American business interests with the bulletins that make their success or failure; yet when the working hours came on the day of the fire, in every exchange in the country, in every importing or exporting house, in the weather bureaux, in every newspaper office, in Chicago and New Orleans, San Francisco and Boston—everywhere was the one thought: "What shall we do without NEWS?"

That the question was not a more serious one to the business part of the community was due in part to chance and in part to the splendid energy displayed by the Western Union officials. By great good fortune the building further up Broadway formerly occupied by the Baltimore & Ohio Telegraph Company was still at the disposal of its successor, the Western Union; and before the flames were subdued the work had begun of installing a substitute plant. In addition to this, an enormous force of messengers was at hand, and the Jersey City and Brooklyn offices were used to relieve the rush.

There is little to be said in regard to the fire; it occurred at the best possible time of the day, when few people were in the building, and no lives were lost; and in money value the property destroyed amounted to less than a hundred thousand dollars. But certain morals are forced to our attention by the enormous results of so insignificant a blaze.

The first of these is the fatuity of putting one's trust in buildings usually denominated fireproof. The Western Union's structure was an excellent one, as such structures go; but it would have been a poor place to store paper money, or even gold. It is evident, nevertheless, that the centre, the heart, of the telegraph system of a great country should have as secure a domicile as the Treasuary of the United States or the Bank of England. This moral has already been borne in upon the Telephone Company, of New York, whose lines, we are glad to say, in large part centre in a building that an earthquake would injure but little, and a conflagration not at all.

The second moral is that a great city like New York should have not one but two telegraphic centres; or, at least, that from a point outside the city many lines should be duplicated, with arrangements for switching important sets of wires from one station to another. In this way such trouble as was caused last week would in large measure be avoided.

A third moral—and this is as well looked in the face as avoided—is that it is, to say the least, unfortunate that the best insulating materials now used are in a high degree inflammable. We are led to wish, after witnessing the speed with which this fire ate up the wires in the Western Union building, that the artificial gutta percha recently hearalded in England might be a non-combustible compound; and we are led to wonder whether the various interior conduit companies cannot devise a less bulky means of covering their wires, so that their systems might be possible in central stations. A separate tube for each of 2,000 wires in one room is of course an absurdity; but something in this direction may yet be accomplished.

Finally, is it not evident that the Associated Press of the country should keep duplicates of its codes, and have offices distinct from those in a telegraph building? Of what use was it to receive cable dispatches promptly after the fire, when these had to remain untranslated until a code could be brought from Baltimore?

Great is the telegraph; and although it cannot defend itself against blizzards, such as upset the eastern systems in March, 1888, it ought at least to be independent of insignificant fires. That it will be so in future, and that this accident will prove a valuable lesson, the intelligence and activity shown by the officers of the Western Union Company this week give us every reason to believe.

Electricity in a High School.

Those of our readers who felt the great importance of the reflections of Mr. Scheible, given in our columns on July 19, will be glad to hear that in at least one school a considerable beginning has been made for carrying out the plans promulgated in that article. Apropos of what was then said, we have been informed that at the Newark High School a great deal of serious and valuable practical electrical engineering has been done, and by boys whose youth makes their comprehension of electrical designing very remarkable and gratifying and proves what we stated editorially in commenting on Mr. Scheible's note, that no better means for the development of youthful intelligence can be found than that of interesting boys in the beauties and mysteries of electrical apparatus.

The original impetus to this work in the Newark school was given by the offer of handsome prizes to the students who should construct with their own hands the best pieces of machinery presented by the class. This liberal offer was made by Mr. W. J. Hammer, the well-known electrical expert, after his experience at the Paris Exposition, where he had taken with him two boys out of this school and had found them valuable assistants in his work.

Frank M. Potter, Jr., who received the first prize this year, made one of the best pieces of apparatus ever constructed by a member of the class. It is a Ruhmkorff coil, and it has been put to practical use in the school. It is more powerful than one that was purchased for the use of the class and which cost $40. He has also made a plunge battery to be used with it. A Holtz influence machine made by him, and modelled after a machine costing $100, is one of the finest pieces of workmanship handed in this year. It has one stationary and two revolving glass plates, condensers, pulley-cords and everything complete. Potter also exhibited a neatly finished microphone. In conjunction with William Cone he made a large electro-magnet, which has not yet been tested. A similar one made last year would support the weight of a man

John Williams, who received the second prize, constructed a rotating mica disc, which works better than one that cost $12. The materials for it cost only 75 cents. The work was neatly done, the brass work being turned in a lathe. He also made an induction coil, and his pocket galvanometer, for testing electrical currents, was one of the best made. Every boy in the class made one of these. Each of them also made a delicate spring balance, some of them rough in appearance, but all of them accurate. Almost every boy handed in a Leyden jar, an electrophorus and an electroscope.

George Wallace and Walter Van Blarcum together made a reflecting galvanometer, on the principle of the Thomson apparatus. It is a creditable piece of work and can be put into a practical use for testing currents. A number of electric motors were handed in, the one made by Harrison Van Duyne, Jr., being especially good. It has six electro-magnets, three on each side of the central armature. It has been the admiration of many of the boys. Arthur Barnes made as many good pieces as anybody in the class, one of them being an excellent induction coil. A large sonometer that will be very useful in class work in sound was made and presented to the class by George Wallace. It is used to illustrate the formation of the gamut and other phenomena of vibrating strings.

A neat piece of Yankee skill is a compound lever whittled out with a jack-knife by John Williams. A frictional plate machine, not so elaborate as Potter's, was constructed by William Cone. Every part of the apparatus he made himself, and it has been in practical use in the class. As there is no workshop in the school, the boys have been obliged to do most of their work at home or in the shops of accommodating mechanics, while some of the work has been done in the boiler-room of the school.

Professor Sonn, the instructor, is a graduate of the school. He is greatly interested in the work of his scholars and is making an effort to get suitable room and appliances in the school for their use.

An outgrowth, in part, of this work in the High School is the Franklin Experimental Club, organized in Newark by a number of scientific and professional men. In its rooms are already to be found many of the most interesting and valuable electrical machines, instruments and apparatus, and in the ranks of its members are not only the brightest and cleverest of the boys who graduate from the High School, but also a number of well-known electricians. The club has facilities for displaying almost every kind of electrical experiment, and no more attractive place is to be found, so far as we know, for the laymen to acquire an interest in the newest of the sciences.

The World's Columbian Exposition.

The Illinois Legislature convened on the 23d inst. for the consideration of matters pertaining to the World's Exposition, to grant the necessary authority to the city of Chicago to raise $5,000,000 for the benefit of the Exposition, and to confer authority covering such action as may be found necessary for the city to take in reference to the ground on which the buildings shall be erected. While the National Commission named two sites, the Lake front and Jackson Park, for the Exposition, it may be considered probable that the Lake front site will be employed. The following section of the act of Congress is important to foreign exhibitors:

SEC. 11. That all articles which shall be imported from foreign countries for the sole purpose of exhibition at said exposition, upon which there shall be a tariff or customs duty, shall be admitted free of payment of duty, customs fees, or charges under such regulations as the secretary of the treasury shall prescribe; but it shall be lawful at any time during the exhibition to sell for delivery at the close of the exposition any goods or property imported for and actually on exhibition in the exposition buildings or its grounds, subject to such regulations for the security of the revenue and for the collection of the import duties as the secretary of the treasury shall prescribe. *Provided*, That all such articles when sold or withdrawn for consumption in the United States shall be subject to the duty, if any, imposed upon such articles by the revenue laws in force at the date of importation, and all penalties prescribed by law shall be applied and enforced against such articles, and against the persons who may be guilty of any illegal sale or withdrawal.

All the Eastern electrical journals, as well as the Chicago daily papers, have referred in complimentary terms to the nomination of Prof. J. P. Barrett, city electrician of the city of Chicago, to have practical charge of the electrical section of the Exposition; and numerous messages of congratulation, coupled with offers of assistance and requests that their names may be added to the long roll of petitioners, have been received from prominent members of the fraternity residing in various sections of the country. All this is very complimentary, but it should not cause Prof. Barrett's friends to lessen their labors in his behalf; on the contrary, it should stimulate them to work all the harder to secure the signatures of every representative company both East and West, and thus show the commission that their choice is the unanimous choice of the entire electrical fraternity. Thus only can success crown their efforts.

Electrical Engineering at the College of New Jersey.

BY WILLIAM ELMER, JR.

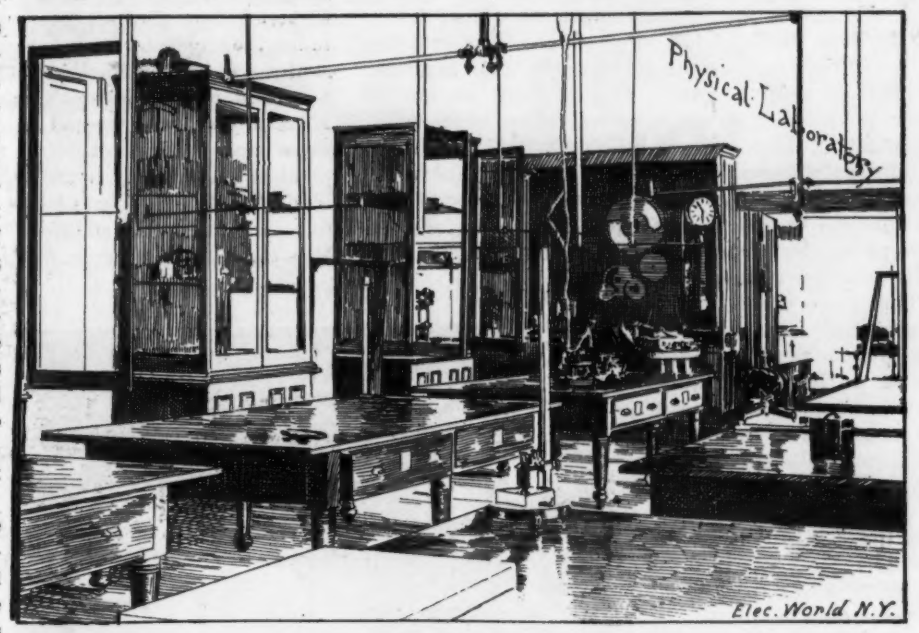
Princeton has recently established a School of Electrical Engineering, which is designed to give a thorough training in both theoretical and applied electricity. The course proper extends over a period of two years, but must be preceded by a preliminary three years' course in the School of Science, or its equivalent. These first three years are essentially the same as the course in the Department of Civil Engineering, and the subjects required for admission are the same. They include the English branches; in mathematics, arithmetic entire, with the metric system, algebra through quadratic equations, radicals, evolution and theory of exponents, plain geometry entire; in languages, either French or German grammar and translation. In the freshman year a great deal of attention is paid to mechanical and technical drawing. This will be of great service to the engineer in designing machinery, stations, etc. Throughout the entire course great stress is laid upon the mathematics, and the work therein is very rigid. At the end of the junior year the regular student is prepared for and admitted without further examination to the Department of Electrical Engineering. The course in mathematics has been completed through differential and integral calculus; descriptive geometry, shades, shadows and perspective, and spherical projections; a course in general chemistry and crystallography; physics, using Anthony and Brackett as a text book; geodesy, analytical mechanics, French and German, English.

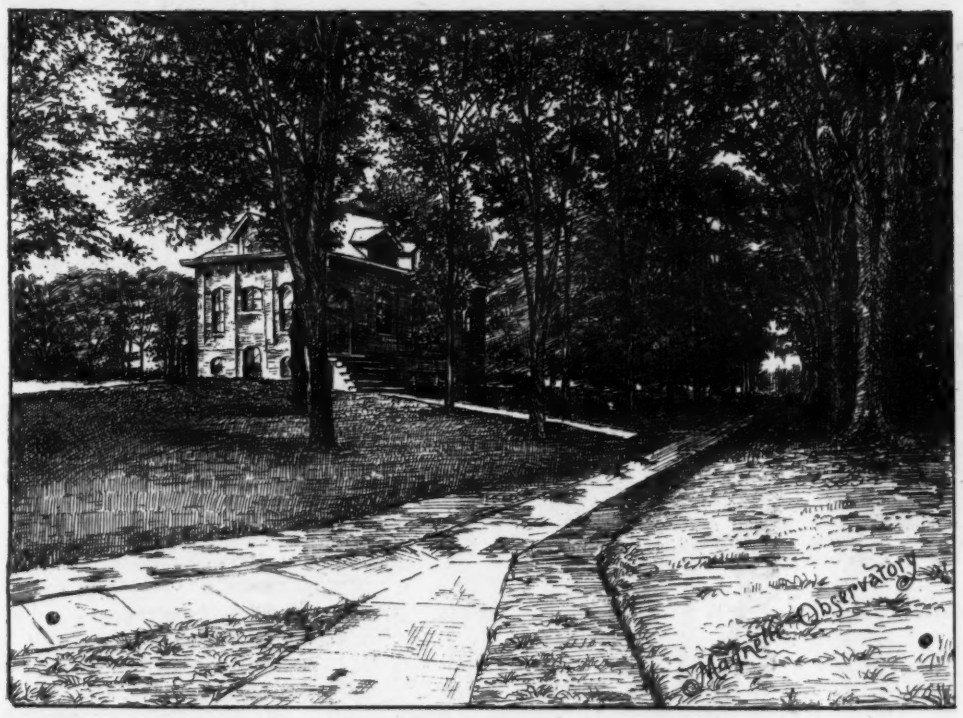
The student now enters the electrical course proper, although during the first year some of the work is with the regular required senior course. It includes applied mechanics, theory of machines and prime motors, mechanism and machine drawing and strength of materials. Mascart in the original French, forms the basis for the mathematical theory of electricity for this year. Maxwell, Cumming and others are used as contemporaneous references. Vol. IV. of Wüllner's "Experimental Physik," in German, and Joubert's treatise, Vol. I., gives the general electricity. Eight hours a week are given to the study of these subjects throughout the entire year. Elementary electrical measurements are made in the laboratories, the text books used being Stewart and Gee, Kohlrausch, Slingo and Brooker, Gray, etc. Two entire days each week are devoted to this work.

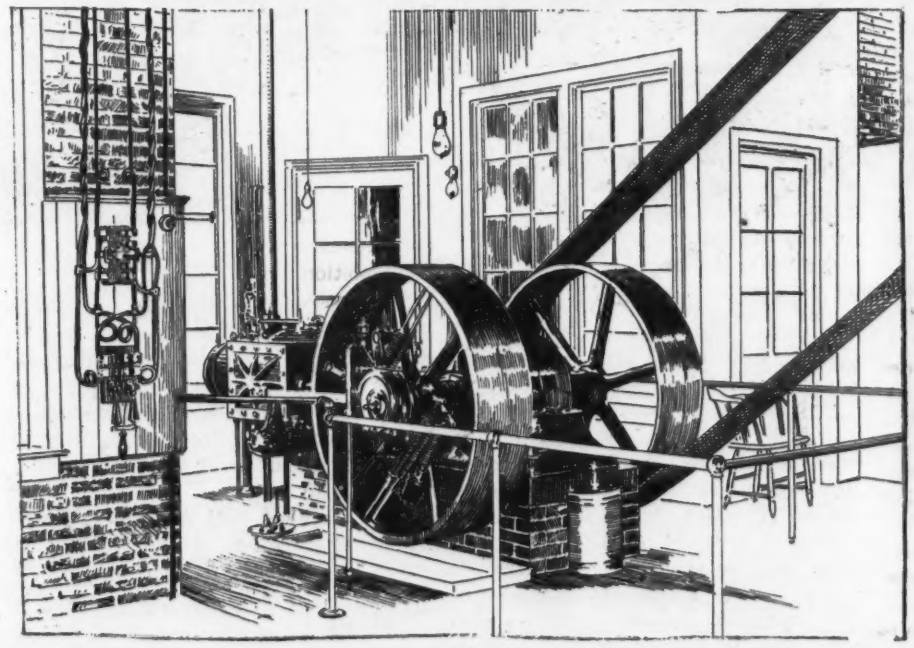
In the second year the theory of electrical measurements is studied and Fleming's "Alternate Current Transformer" is read, occupying four hours a week for half the year. Vol. II. of Mascart and Joubert's "Treatise on Electricity" occupies four hours a week for half the year. A course of four lectures a week on dynamo design and construction is given. Thompson's "Dynamo Electric Machinery," with Kapp, forms the basis for this course. Four lectures a week through the entire year are also given on the technical applications of electricity in telegraphy, telephony, electro-chemistry and electro-metallurgy, systems of electric lighting, and the transmission of power. Advanced electrical measurements and the testing of the various machines form a part of the second year course. Meetings are held once a week, in which the students present reports and discussions on the current electrical literature. In addition to the facilities afforded by the laboratories of the John C. Green School of Science, two buildings specially designed and constructed have been provided to meet the requirements of this course. The dynamo building is located at the corner of Washington and William streets, adjoining the School of Science, with which it is connected.

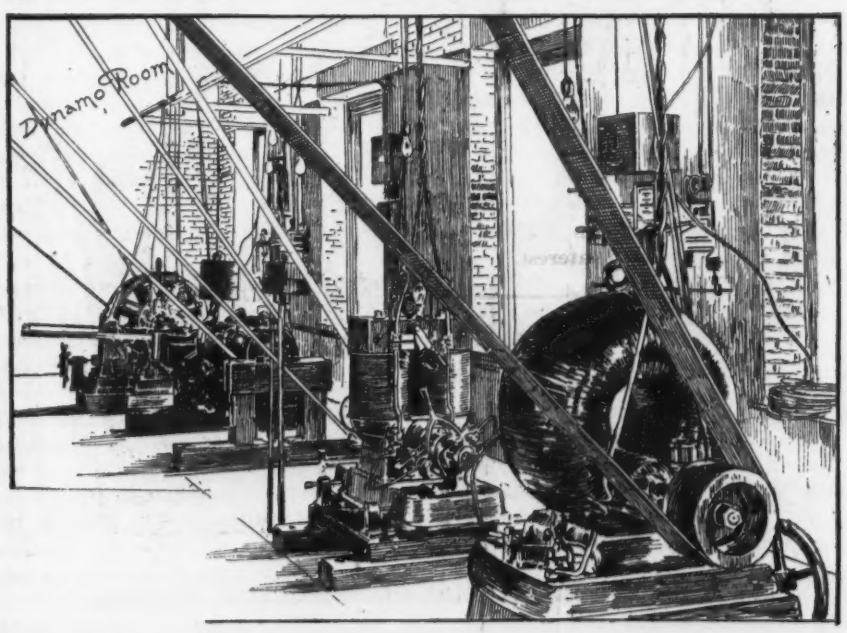
The building is L shaped, the boiler and engine occupying one wing of the L. It is constructed of rough ashlar brown stone with light sandstone trimmings, and makes a very pretty companion to the majestic Scientific School building.

The dynamo room is 53 feet long, well lighted and ventilated. The floor is of artificial stone, flush with the heavy timbers which form the foundations, to which are bolted the bed plates of the machines. The engine belts to a countershaft at the ceiling, from which the dynamos take their power. Each belt pulley has a separate clutch controlled by a long handle from the floor. It is the intention to have all the machines mounted on dynamometers, but at present only the Brush arc is so arranged. A 60-horse Babcock & Wilcox boiler supplies steam to a 60-horse Ball tandem compound engine which furnishes power for the machines. The arrangement of coal is very convenient









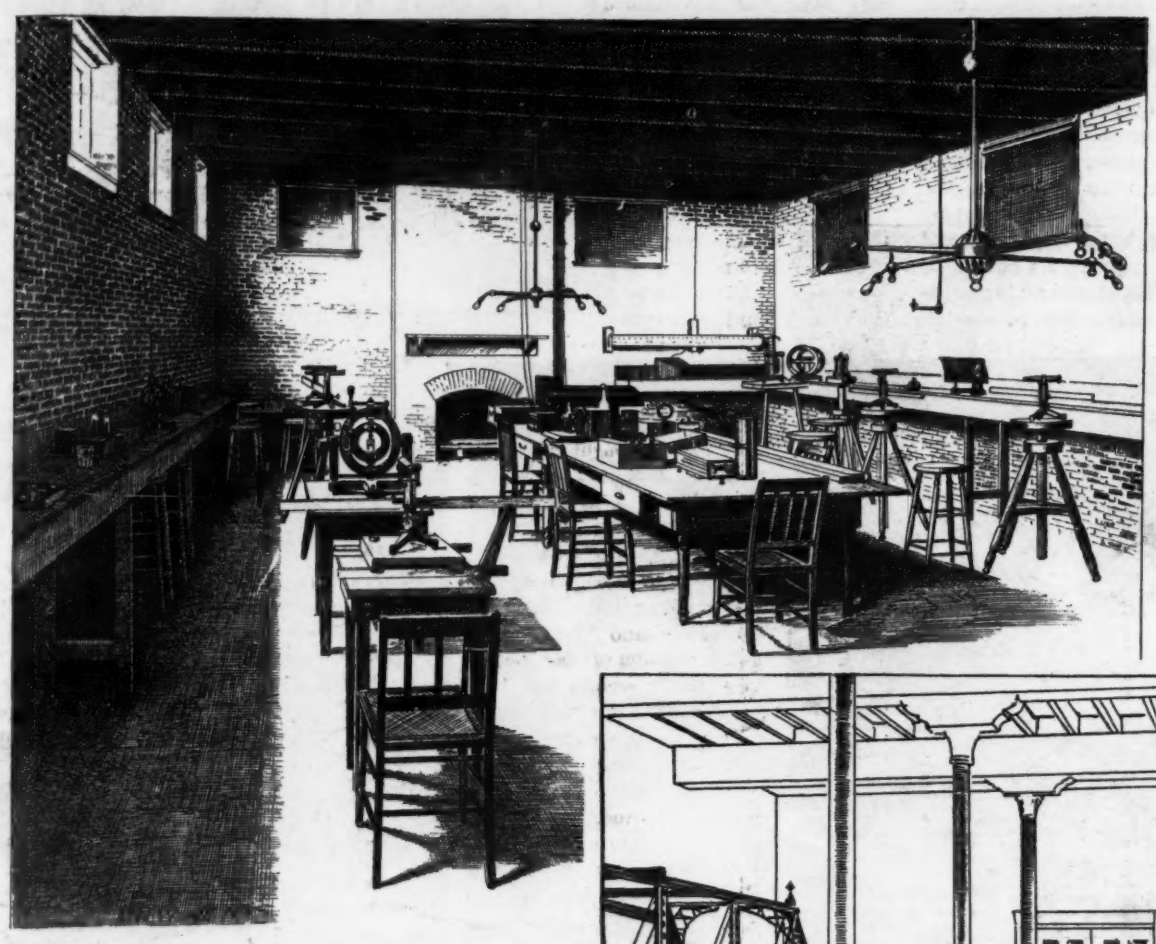
THE SCHOOL OF ELECTRICAL ENGINEERING AT PRINCETON COLLEGE.

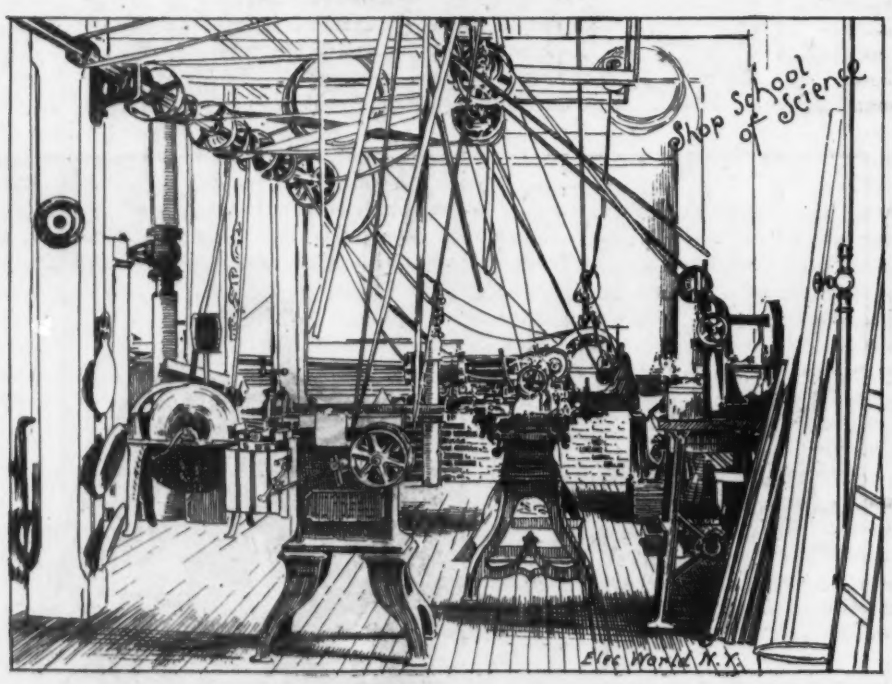
Wagons deliver it into the vault at the street level, and in the boiler room it runs out on the floor just at the front of the furnace. A Worthington pump feeds into a Baragwaranth heater. The exhaust steam from the engine passes into a well, from thence to another, and finally into the stack. Very little steam is left uncondensed, so that the exhaust is not annoying.

The largest of the dynamos is a Westinghouse alternate current machine of 500 lights capacity. It is of the so-called self-exciting type, the exciter armature being driven from the main shaft. A full outfit of converters, switches and measuring instruments accompanies this machine. The next is a Brush arc. This is rated as an 18 lighter and supplies current to several lamps in the building and shops. Then come an Edison 200 light, a Mather 250, a Brush incandescent of 100, and an Eickemeyer of 50 lights. There is also an 80-light compound wound machine that was constructed in the shops, and is used for lighting the physics lecture room. A small Gramme machine is in use for charging storage cells, of which there are four sets. Power is now supplied to the shops by a 6 h. p. motor, which replaces a Hewes & Phillips engine. Another motor, run from storage batteries, is in use in Halstead Observatory, replacing a gas engine.

In connection with the dynamos there is, in one end of the building, a large rheostat of German silver wire capable of absorbing more than 50 h. p. This exceeds the capacity of the largest machine, so that in testing full loads may be given.

The magnetic observatory is situated some little distance from the dynamo building, and in fact from all buildings, so as to be removed as far as possible from magnetic influences. There is no iron in its construction, copper and brass having been used throughout, even the little motor used for stirring the tanks in which resistance coils are submerged being built with no iron in its cores. The main laboratory in the basement contains most of the delicate instruments, being so placed on account of the equality of temperature thus attainable. A reading room and private laboratory occupy the first floor, and the second is one large room, used in special investigations.





ELECTRICAL LABORATORIES OF PRINCETON COLLEGE.

The laboratory contains a full outfit of measuring instruments, among which may be mentioned a large physical balance, Thomson's quadrant electrometer, Thomson's electrostatic electrometer, specially constructed galvanometers by Edelmann, Hartmann and Elliott, Thomson's ampère balances, and two large resistance boxes adjusted by Anthony. Besides these there is a complete equipment of galvanometers and all other instruments needed in accurate work. This building is connected by means of large copper conducting wires with the laboratories of the School of Science and with the dynamo building, so that its standard instruments may be used for standardizing the many measuring instruments that these contain.

Growth of Electric Lighting in Berlin, Germany.

The electric lighting system of Berlin, both in size and completeness, compares favorably with that in any of the large cities of the world. A German contemporary, referring to the growth of the past few years, says that five years ago the Edison Gesellschaft, now the Allgemeine-Elektricitätsgesellschaft, erected a small plant for 2,000 lamps at No. 85 Friedrickstrasse. When the Allgemeine-Elektricitätsgesellschaft obtained permission from the city to use the streets for laying electric cables, a second central station was built in Markgraffenstrasse. It had a capacity of 1,000 h. p. A third small station, with three engines of 270 h. p. each, was erected in Mauerstrasse, but in 1887 three more engines of 300 h. p. each were added to the plant at this station. In the beginning of 1888 the station in Markgrafenstrasse was found to be too small, and had to be enlarged by the addition of four steam engines of 300 h. p. each. Then a fourth, fifth, and finally a sixth station were erected, and each was provided with vertical engines of 1,000 h. p. The dynamos were of the newest type and were manufactured by the firm of Siemens & Halske. Each of these machines, the ring armature of which has a diameter of from 2½ to 3 metres, supplies electricity for incandescent lamps of 90,000 aggregate candle power; that is for about 6,000 lamps of 15 candle power each. Altogether Berlin seems to be making progress at least as rapid as that shown for Paris in the figures recently given in our columns.

The Cost of Transmitting Power.

The following comparisons of cost of transmission of power by various methods appeared in the *Revue Universelle des Mines:* (1) Comparative cost of 10 h. p. transmitted 1,093 yards: By cables, 1.77 per effective h. p. hour; by electricity, 2.21; by hydraulics, 2.90; by compressed air, 2.98. (2) Comparative cost of 50 h. p. transmittted 1,093 yards: By cables, 1.35 per effective h. p. hour; by hydraulics, 1.87; by electricity, 2.07; by compressed air, 2.99. (3) Comparative cost of 10 effective h. p. transmitted 5,465 yards: By electricity, 2.64 per effective h. p. hour; by compressed air, 4.66; by cables, 4.69; by hydraulics, 5.29. (4) Comparative cost of 50 h. p. transmitted 5,465 yards: By electricity, 2.37 per effective h. p. hour; by cables, 2.65; by compressed air, 2.99; by hydraulics, 3.02. Steam was the prime mover used in each of the above instances.

The Sims-Edison Torpedo Boat.

About fifty men accepted the invitation of the Sims-Edison Electric Torpedo Company on the 15th inst., to witness a trial of the company's fish torpedo at Willett's Point. The fast tug Fred B. Dalzell was chartered for the occasion. The exhibition was arranged particularly for the benefit of Captain L. F. de Saldanha de Gama, of the Brazilian Navy; S. de Weckerlin, Minister for the Netherlands; P. Lascano, the Chilian Minister, and A. Thompson Reid, Commissioner of the government of Chili. Those gentlemen as the guests of the officers of the Sims-Edison Company were conveyed to Willett's Point on the steamer E. B. Dalzell from the foot of Wall street, together with the following guests: H. Von Kohler, the Swedish electrician; ex-Senator Warner Miller, Civil Engineer A. G. Menocal, U. S. N.; Lieut. Arthur B Speyers, U. S. N.; Henry M. Monroe, John D. Jones and A. A. Raven, of the Atlantic Marine Insurance Company; John R. Livermore, George W. Quintard, James Wilson, Warren E. Hill, Darwin R. James, Robert S. Benedict. Chief Engineers Albert W. Morley, William W. Heaton and Albert Moritz, U. S. N.; Leicester Holme, Counseller John H. Corwin and Lawyer E. M. Fox. Upon arriving at Willett's Point the company was received by Col. W. R. King, Dr. Ewen, Dr. Kilbourne and others. With Mr. Sims operating the electric keyboard on the dock the torpedo boat shot straight out into the bay with a loud whirr. The water was thrown in double sprays covering the fore part of the float, but the stern rode three inches out of water when the boat was under a full headway. Mr. Sims steered her out and around an old hull lying off shore, and taking a graceful sweep brought her round in a wide loop back toward shore, crossing the line of direction and landing within fifty feet of the pier when the 5,550 feet of cable that she carried had been paid out.

There was not the slightest halt, delay or apparent deviation from the course intended. All the visitors agreed that the trial could not have been more successful. As equipped for this run the boat would have carried about 265 pounds of dynamite.

Two charges, consisting of 50 pounds of mortar powder each, were then exploded under water by electricity. One of these explosions threw a column of water upward to a height of about 200 feet. A new torpedo boat of a similar type is in process of construction by Mr. Sims for the United States Government, to be ready next fall. This boat is expected to run two miles at the rate of 20 miles an hour, and will carry 450 pounds of dynamite. It will be 33 feet long, and have a cylinder 25 inches in diameter.

An Electric Road in Berlin.

The first electric car on the street railways of Berlin, was put into service on the 3d of June, running from Behren Strasse to the Kreuzberg. The passengers were amused to find, in the interior of the car, a sign bearing the English words "No Smoking."

The Perret Multipolar Motors.

The cuts given on this page illustrate a new line of low speed multipolar motors. These machines were brought out last year and have been giving satisfaction wherever introduced, but a detailed description has never before been published, as it was desired first to thoroughly test them in actual work and to secure patents, which has now been done. They were designed by Mr. F. A. Perret, of the Elektron Manufacturing Company, Brooklyn.

They differ from his well-known two pole motors mainly in that they are of the multipolar type, which form has now been adopted for all sizes above 2 h. p.; and the Company are carrying in stock machines of 4, 6, 8, 10, 15 and 20 h. p. wound for 220 volts, or wound to order for any E. M. F. between 100 and 500 volts.

It seems to us that these multipolar machines are specially meritorious, as they combine the important features of high efficiency, extremely low speed and close regulation without excessive weight and bulk. It is found in the electric motor field as elsewhere, that each make has its peculiarities, one excelling in this feature, another in that, and it is unusual for any one machine to excel in all of the three features mentioned. It is well known that most motors and dynamos are run at a high rate of speed, because the efficiency, regulation and output now demanded cannot be obtained at a low speed with ordinary construction. In the opinion of many of the best electrical and mechanical engineers of the country this high speed is objectionable on various grounds, and many of them have during the past year recorded their belief that the next great advance would be in the line of a large reduction in speed. Mr. Perret has been putting this prediction into practice in a very effective way. That the improvement made by him is a radical one is apparent from the simple statement that the revolutions of armature per minute in the ordinary shunt-wound Perret motors of the new type are between 600 and 500 in the sizes ranging from 4 to 20 h. p., which is less than half the speed of most others; and for special work they are wound to run 350 revolutions or even less.

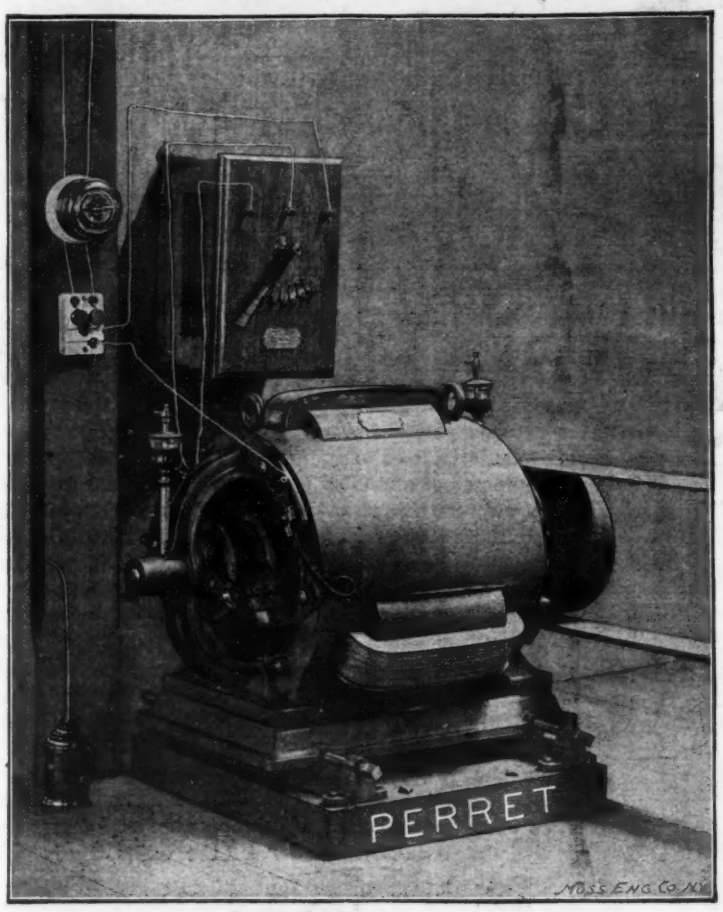


FIG. 1.—PERRET MOTOR.

It is, of course, understood that motors have been built which ran nearly as slowly, but they were made expressly for some special work and were very heavy, bulky and expensive, considering their power. It is a very different matter to put the low speed machines on the market at the same price as ordinary high speed motors, as is now being done. We hope the business will be as profitable and satisfactory to the company as the machines are satisfactory to their customers.

It is not as fully understood by the general public as by builders and electricians that reducing the speed of the dynamo electric machine reduces the power or output corresponding, and increasing the speed increases it. For example, a certain Perret motor, running at 600 revolutions per minute develops 4 h. p. If it were wound suitably and were run 1,200 revolutions per minute (which is lower than many others), it would be 8 h. p., and the price for an 8 h. p. machine could be obtained.

The practical advantages of low speed machines are many. For instance, in ordinary machine shops, woodworking shops, printing offices, etc., the shafting is commonly run 200 to 300 revolutions per minute, and it is a simple matter to belt direct to it from a motor running 500 to 600 revolutions, thus saving the first cost of a counter-shaft and one belt, and saving considerable power which would be lost in transmitting through the counter-shaft and additional belt generally used with a motor running 1,000 to 1,500 revolutions. The same applies in the case of an elevator operated by belt, and in elevator work, indeed, it is possible to gear direct from the motor. The Perret machines have recently been applied by direct gearing to pumps and to coal cutting machines in mines, also to the operation of coal-cutting machines by means of rope belt transmission from the motor to the cutter, and the company now have some very large orders for this class of work, which would have been very difficult with motors of high speed.

The motors are peculiarly adapted to the direct driving of large exhaust fans and blowers, and to operating hoists and traveling cranes, and it is to be hoped that they may be applied soon to street railway work, where they would doubtless effect a considerable saving of the power now wasted in the gearing, a very large item.

In addition to the advantages of low speed in the special cases mentioned, there is, of course, in all cases a general advantage in the avoidance of the rapid wear and deterioration usually connected with high speed.

This unfortunate quality of high running speed has done much to hinder the introduction of the electric motor into large classes of work. The present multipolar machines are built with a six pole field and with armatures of large diameter, thus securing a powerful torque and great momentum of armature, which is a decided advantage when a heavy load is thrown on suddenly, as is often the case in elevator work and all sorts of hoisting.

It is quite remarkable that Mr. Perret has been able economically to retain in these larger machines the distinctive feature of laminated field magnets for which his smaller machines are noted. The laminated structure of the magnets not only permits the use of a high quality of wrought iron for the magnetic circuit, but also obviates the eddy currents that are liable to arise in using the otherwise very desirable Pacinotti type of armature.

In the illustrations, Fig. 1 is a side view of a 20 h. p. motor complete, with sliding base and starting box. Fig. 3 is an end view of the same, and Fig. 2 is a diagram showing a cross section of the magnetic circuit. This large motor weighs but 1,200 lbs., thus showing a remarkably high rate of output in proportion to the amount of iron and copper used.

It will be seen that the armature is a ring of comparatively large diameter, with longitudinal channels on its periphery in which the conductors are wound and thus embedded in the iron, which is in such close proximity to the iron pole pieces that there is but a very small gap in the magnetic circuit.

The field, as appears from Fig. 2, consists of three separate magnets arranged at equal distances around the armature, each magnet having two pole pieces. The winding is such as to produce alternate north and south poles, and is singularly simple, as each coil energizes two poles very strongly and economically. The magnets are built up of plates of soft charcoal iron, which are shaped as shown in the diagram, and the magnet thus produced is of such form that it may be readily wound in a lathe. The field winding is generally shunt, but for special purposes both series and compound windings are employed. A non-magnetic bolt passes through a hole in each pole piece, and the plates are clamped together between washers and nuts. These bolts also serve to attach the magnets to the two iron end frames, which are of ring shape and are bolted to the bed plates of the machine. The magnetic circuit thus formed is of unusually low resistance by reason of its shape, its shortness, which is shown by the diagram, and the superior quality of iron used. There is no magnetism in the frame, bed, or shaft of the machine, as the magnets are supported at some distance from the frame by means of the non-magnetic bolts, and the armature is mounted on the shaft by spiders of non-magnetic metal.

Thus the motor is a comparatively easy one to build, a great advantage when we consider that the use of wrought iron for the fields and extreme care in the construction of the magnetic circuit are usually attained only by extensive and costly machine work, necessarily increasing the price of the finished product.

There is, therefore, very little opportunity for magnetic leakage, and, furthermore, the whole is enclosed by a shield or case of sheet metal, as shown in Fig. 1. With such a construction it is not strange that the motors have already secured a good reputation for high efficiency and close regulation, as well as for low speed.

These multipolar machines are calculated to be equally efficient and desirable as dynamos, and are coming into use rapidly in small isolated incandescent light plants. For this purpose they are compound wound, and the regulation is so perfect that all but one lamp may be suddenly turned off without moving rheostat or brushes, and without noticeable change in the brilliancy of the remaining lamp. This severe test has been made repeatedly with uniform success. Used as dynamos, their very low speed makes them well suited for direct connection to steam or gas engines, in cases where belting cannot well be used, as well as in lighting railway trains, yachts and the like.

The Elektron Manufacturing Company has recently added largely to its cash capital, to enable it to handle

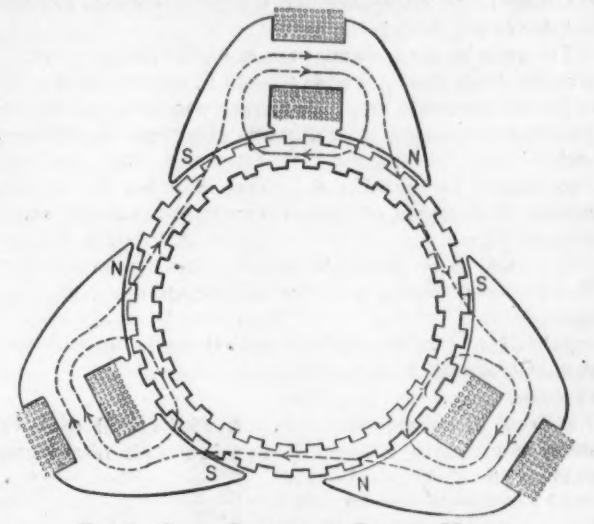


FIG. 2.—CROSS SECTION OF PERRET MOTOR.

properly its large and constantly increasing business, and has doubled its manufacturing facilities twice during the last six months. It now occupies nearly all of the large new factory building Nos. 79–81 Washington St., Brooklyn N. Y., and is admirably equipped for the successful prosecution of its work.

Contributions to the Molecular Theory of Induced Magnetism.*

BY PROFESSOR J. A. EWING, F.R.S.

After referring to Maxwell's discussion of Weber's theory, which ascribes magnetization in iron and other magnetic metals to the turning of molecules which are already permanent magnets, and to suggestions made by Professors Wiedemann and Hughes, and lately by Mr. A. E. Kennelly, the writer describes experiments which he has made directly bearing upon the molecular theory. The experiments were made by grouping near to one another a large number of small permanent magnets, each pivoted on a fixed centre, and by studying the manner in which the configuration of the group changed when external magnetic force was imposed. The results do not support the notion that the molecular magnets form closed chains in unmagnetized iron. They lead, however, to the important conclusion that no arbitrary conditions of directional constraint need be postulated to make the manner in which the molecular magnets turn agree with the chief features of magnetic quality. In the writer's view the molecular magnets are perfectly free to turn in response to external magnetic force, except in so far as they are constrained by the magnetic forces which they exert upon one another. He discusses this theory in a preliminary manner with regard to the form of the magnetization curve, the character of the cyclic processes, the effects of temperature, of vibration, of stress, and so forth, and shows that it is in general agreement with the known facts. The summary of conclusions is as follows:

1. That in considering the magnetization of iron and other magnetic metals to be caused by the turning of permanent molecular magnets, we may look simply to the magnetic forces which the molecular magnets exert upon one another as to the cause of their directional stability. There is no need to suppose the existence of any quasi-elastic directing force, or of any quasi-frictional resistance to rotation.

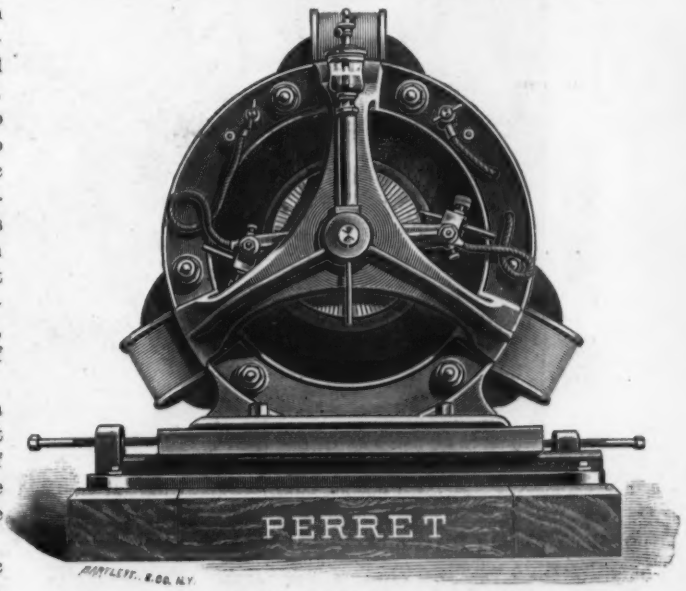


FIG. 3.—END VIEW OF PERRET MOTOR.

2. That the intermolecular magnetic forces are sufficient to account for all the general characteristics of the process of magnetization, including the variations of susceptibility which occur as the magnetizing force is increased.

* Abstract of paper read before the Royal Society, June 19, 1890.

3. That the intermolecular magnetic forces are equally competent to account for the known facts of retentiveness and coercive force and the characteristics of cyclic magnetic processes.

4. That magnetic hysteresis and the dissipation of energy which hysteresis involves are due to molecular instability, resulting from intermolecular magnetic actions, and are not due to anything in the nature of frictional resistance to the rotation of the molecular magnets.

5. That this theory is wide enough to admit explanation of the differences in magnetic quality which are shown by different substances, or by the same substance in different states.

6. That it accounts in a general way for the known effects of vibration, of temperature, and of stress, upon magnetic quality.

7. That, in particular, it accounts for the known fact that there is hysteresis in the relation of magnetism to stress.

8. That it further explains why there is in magnetic metals hysteresis in physical quality generally with respect to stress.

9. That, in consequence, any (not very small) cycle of stress occurring in a magnetic metal involves dissipation of energy.

A New System of Electric Traction.

The great commercial success of the overhead electric railway system has temporarily drawn the attention of inventors almost entirely to the perfecting and development of that method of street car propulsion. Other systems of more or less promise have either been neglected or abandoned altogether in the haste with which the promoters of electric street railway enterprises have sought to take part in the application of that system which met with the greatest and most immediate commercial success. For this reason the storage battery system has, in the last two or three years, been apparently neglected. A few persistent and far-sighted inventors, however, have been quietly working away, encouraged in their efforts to produce a successful system of storage battery propulsion by the unmistakable demand of the railway managers for a system in which no overhead wires would be necessary, and in which each car would be an independent unit. The problems with which these inventors have had to deal are by no means simple. To increase the life of the storage battery plates and at the same time to reduce the aggregate weight of battery which it is necessary for each car to carry presented difficulties of more than ordinary character.

The attention of Prof. William Main has been directed for several years toward a solution of these and other problems connected with a system of storage battery traction, and the results of his labors are embodied in the methods of the River and Rail Electric Company, which we illustrate on these pages. This system possesses many features of great interest; and the details of the car, the battery, the motor and the gearing have all been carefully worked out by Prof. Main.

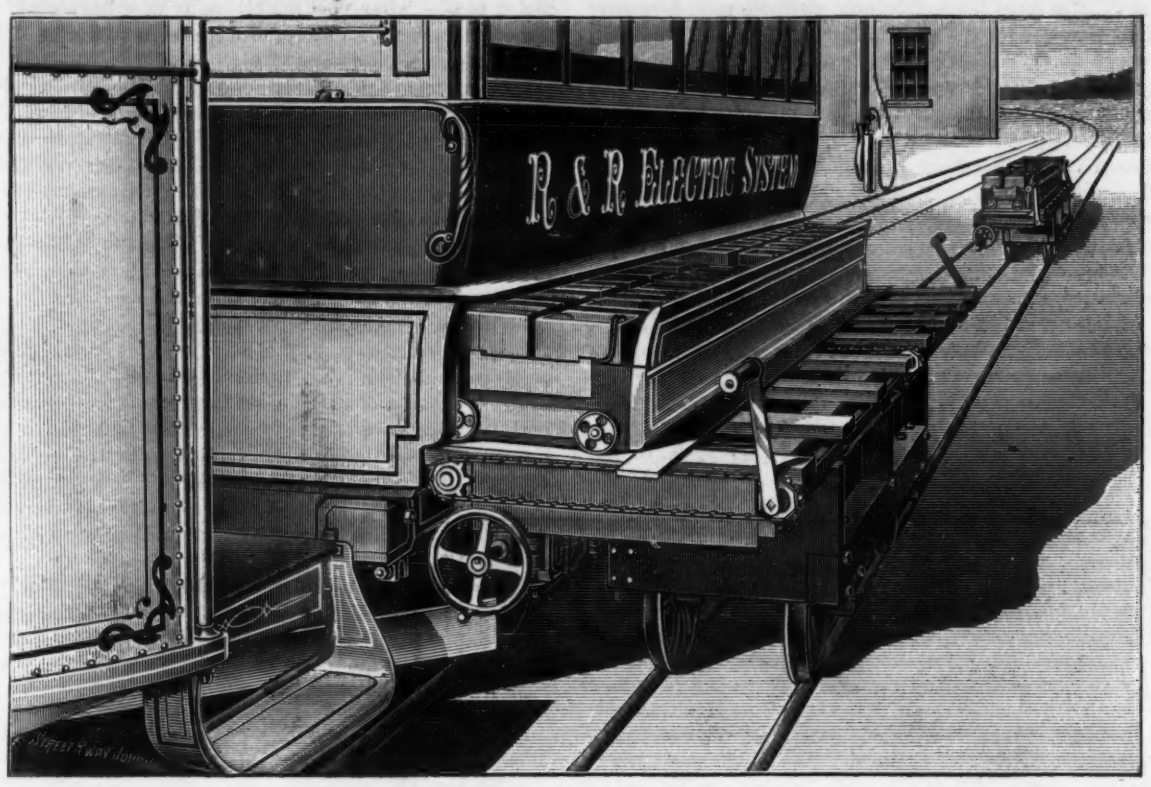


FIG. 1.—RIVER AND RAIL CAR AT SHIFTING STATION.

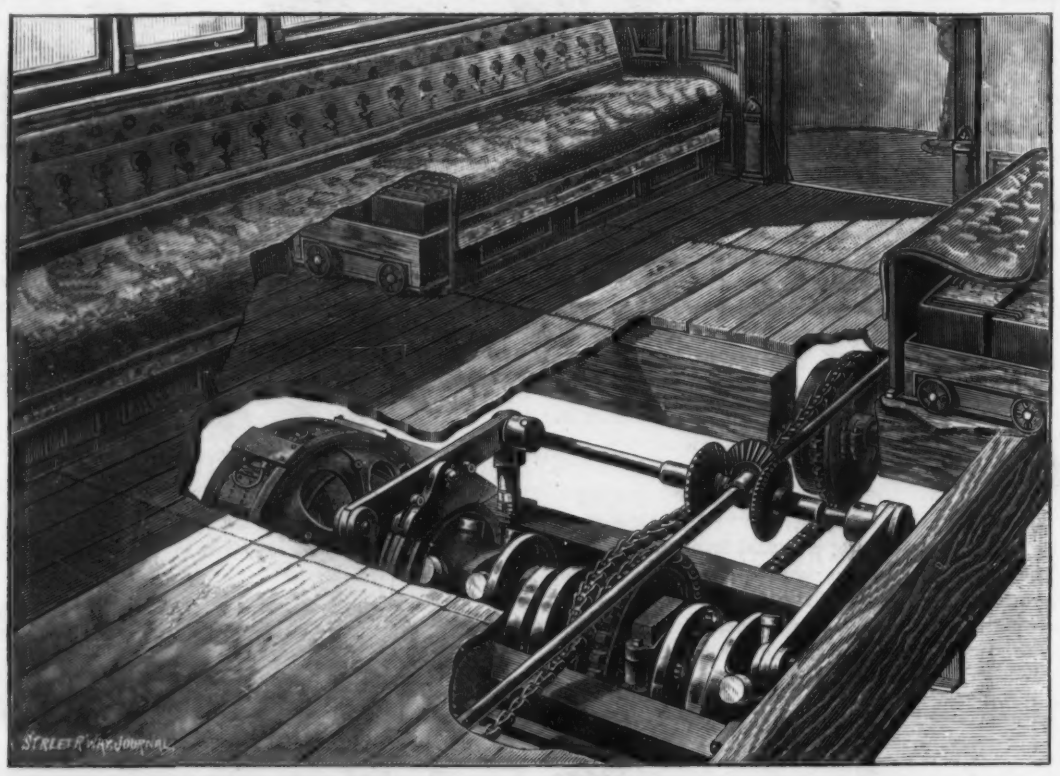


FIG. 2.—CAR OF THE RIVER AND RAIL SYSTEM.

The car itself is not different except in minor details from the ordinary street car. It is, however, built with a stronger frame than is required in horse cars, and has an additional projection of 18 inches at the end of each platform to furnish suitable accommodations for the motorman without in any way interfering with the free exit and entrance of passengers.

The space occupied by the motorman has a circular glass front affording protection to both driver and passengers. The total length of the car is 26 feet 6½ inches. The space for the batteries is entirely underneath the seats of the car, and in order to increase this space the cove panel projects outward slightly more than it otherwise would. Each car has sufficient space for 84 cells, or 42 on each side. They are placed in trays, each tray holding six cells. In the car from which our illustrations are taken, however, only 60 cells are used, the space that holds the centre one of the seven side trays being vacant, and each tray being utilized to carry but five cells. The five cells of each tray are permanently joined together and are moved as a single unit. The trays have sliding spring contacts against which contact strips upon the car press, so that when the trays are put in position the cells are simultaneously put in circuit, and the contact is broken when they are removed from the car.

The shifting of the entire set of 60 cells and the substitution of 60 freshly charged cells in their places can be done, it is said, in one minute; and the ease with which this is accomplished is shown by the fact that it has been done by a lady in that space of time. The battery shifting rack with its mechanism is clearly shown in Fig. 1.

Parallel with the car tracks on each side are narrow gauge tracks on which runs a small car carrying a table. The height of the table at the edge next the car is adjustable, and may be regulated by the hand-wheel seen in the illustration so as to conform to the level of the car floor. The trays are provided with latches which, when the cells are in place, fall into notches provided for them in the car sill. The shifting table carries projections which exactly correspond to these latches on the trays, and when it is brought alongside the car these can be placed directly under the latches, and a turn of the hand-wheel lifts all the latches from their notches and brings the top plate of the table into engagement with the shoulders of the latches. Then a turn of the cranks, one of which is at either end of the table, removes simultaneously all the cells on one side of the car. The opposite side of the car is fitted in the same manner, so that both sides may be changed at once. The entire distance over which the cells have to be moved is less than three feet. The exhausted cells being withdrawn, the table is moved away and another with a fresh set is rolled alongside when a reverse motion of the cranks puts the newly charged cells in place.

The River and Rail battery is also the invention of Prof. Main, and is sometimes called the Main battery. It is based on the Planté type of cell, but differs from it in many respects. Figs. 3 and 5 show respectively the positive and negative plates. In several important particulars they differ from the plates of other secondary cells. There is no active material used in making them. The positive plates are composed of a number of sheets of lead foil pressed together between thin plates of lead and then perforated with many small holes, about 24 to the square inch, after which all is securely fastened by lead rivets about an inch apart. The negative plates are of zinc about one-eighth of an inch thick and perforated with large holes. These rest between plates of copper perforated to correspond. Both zinc and copper plates are thoroughly amalgamated. Fig. 5 shows both the zinc and copper plates. The plates are arranged in the cell like shelves, placed horizontally one above the other. The copper plate acts only as a conductor and the zinc plate, it is claimed, does not waste away, the chemical changes restoring it to its pure condition. When placed in the charging circuit the lead foil of the positive plate becomes an oxide and the oxide of lead thus formed by the action of the current is of a peculiarly hard crystalline structure and is said to be better for the work required of it than the oxide which is mechanically applied in the grid plates. It is furthermore permanently retained, owing to the construction of the plate, and experience has shown that there is no dislodgment either from jarring or rapid discharge. By the use of zinc for the negative plate a higher E. M. F. per cell is said to be obtained, thereby allowing the number of cells necessary for a car to be diminished. The arrangement of the cells in the car is shown in Fig. 1 and also in Fig. 2, where a portion of the seat is broken away to expose them. The fluid part of the cell is an acid solution of zinc sulphate. Each cell gives an E. M. F. of about two and a half volts or a total for the car of 150 volts. The weight of a cell is about 45 pounds, the total weight of battery being considerably less than one and a half tons.

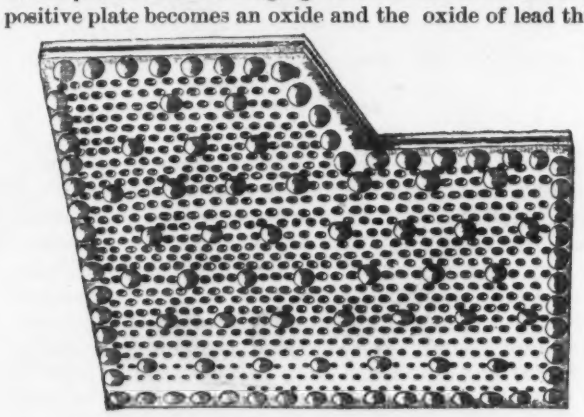


FIG. 3.—BATTERY PLATE—POSITIVE.

The motors used on the River and Rail system are of a type not often met with in this country. Fig. 4 is a perspective view of one as seen from the commutator end. The diameter of the frame of the size used on street cars is a trifle over two feet, and its weight about 900 pounds. The machine is multipolar, having two north and two south poles. Both the coils and core of the armature are station-

ary, as are also the field coils, so that there is no moving wire upon the machine. The field core, together with the poles and the brushes, is carried upon the shaft and revolves with it.

The commutator is stationary. The field core is a cylinder of soft wrought iron about seven inches in diameter and nine inches long, and is concentric with the shaft. The field coils are wound around its periphery upon a stationary spool. The two south poles are at opposite ends of an arm carried upon one end of the drum-shaped core, and

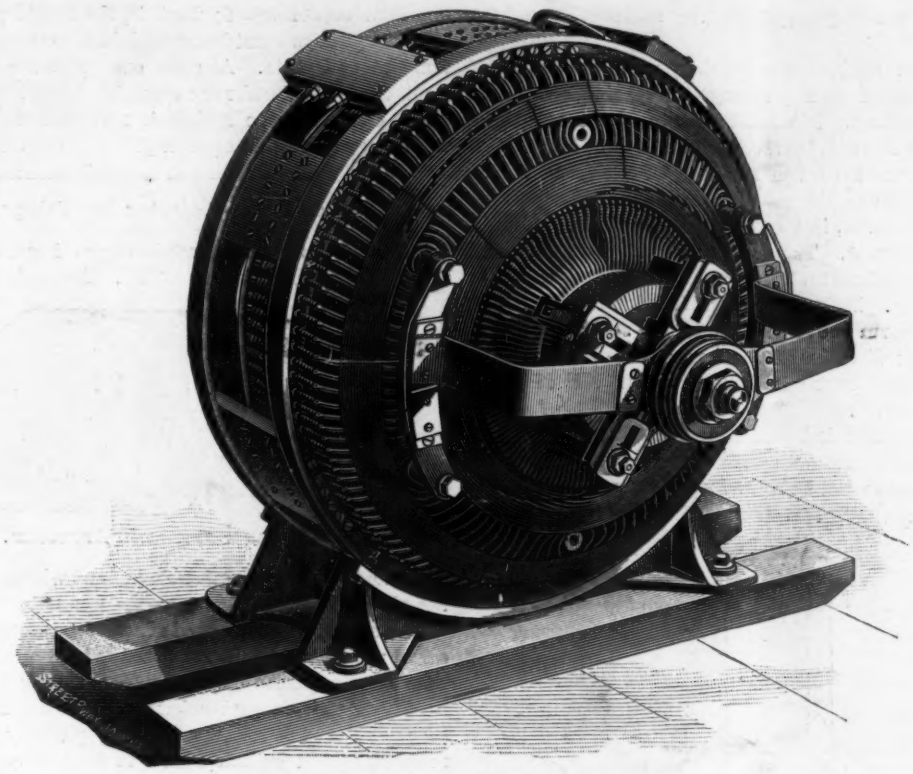


FIG. 4.—RIVER AND RAIL MOTOR.

the two north poles at the opposite ends of an arm at right angles to this carried upon the other end of the core. The magnetic circuit is thus closed through the centre of the field and armature cores parallel with the axis of rotation.

Adjacent poles are thus one quadrant apart and upon opposite sides of the armature. The path of the lines of force passes then through the field core, branching in the pole piece to its two ends, which are of one polarity, into the armature core, where each set again branches to pass in opposite directions a distance of one quadrant around the armature core, and then passing out into the two poles of the opposite arm, and finally uniting again in the core of the field magnet.

The pole pieces are of wrought iron. The brush holder carries four brushes. The armature core is built up of wrought iron bands, so as to obtain the requisite lamination, and has a cross section of about one-fourth that of the field core, since at any one place it is only required to carry one-fourth of the lines of force that pass through the mag-

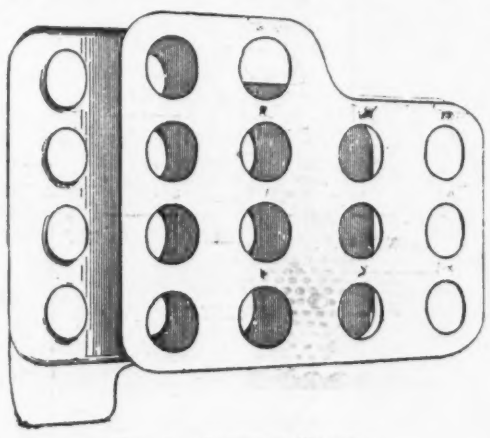


FIG. 5.—BATTERY PLATE.

net core. For the same reason the cross section of the poles is only one-half that of the field core.

The means by which the power of the motor is transmitted to the car is one of the most interesting parts of the system. Fig. 2 is an interior view of a River and Rail car showing a portion of the floor and seats, with such parts of the flooring removed as are necessary to expose the mechanism to view. As may be seen, all there is of this is carried on one shaft, which is coupled to the rotating part of the motor or the armature shaft, as it would be called in a motor of the usual type. It is very compact, and occupies but little space, yet there are two different speeds mechanically provided for, and also means of running the motor independently of the car.

The motor is allowed to run at the speed of 800 revolutions per minute, which gives it a high electrical efficiency and allows it to develop its maximum horse power both in starting the car and in running slowly around sharp curves. The greater ratio of mechanical reduction of speed gives a slow and powerful action to the car wheels while the motor runs with full speed. These changes are effected by the operation of a single lever on the front platform, without jar and without throwing teeth in or out of mesh. The mechanical arrangement is based upon the sun and planet motion with some essential modifications. The central shaft revolves at all times with the speed of the motor. Two portions of this shaft are slightly eccentric with loose pinions mounted upon them. These mesh at all times with the internally toothed gears which surround them. These pinions may revolve idly within the gears or may drive them according as they are allowed to gyrate with the eccentric and revolve, or to gyrate only. The pinions are connected by double gimbal joints to discs concentric with the central shaft. Each disc will revolve with its pinion when idle, but when arrested by the grip jaws will cause the pinion to drive. One pinion or the other is driving, or both are idle according to the position of the platform lever. The two internally toothed gears are connected permanently to each other and to the double sprocket which drives both chains, and action comes from either one or the other, or there is no action, as the case may be. The whole mechanism is lubricated automatically from within by centrifugal action. The oil as it drips down is caught in a metallic pan which encloses and protects the whole under side, and by means of a loose traveling ring returns to a reservoir to be used over and over again.

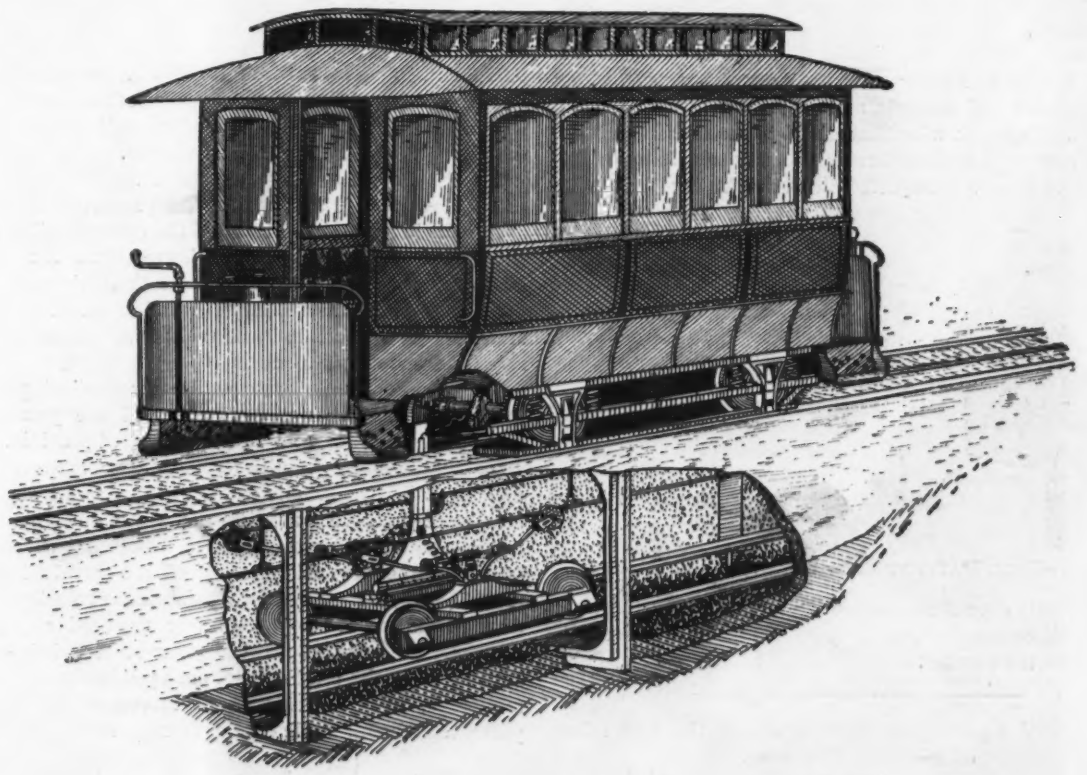
The mechanism drives both axles by means of sprocket wheels and chains, as will be observed, and on the axles are drums to which the sprocket wheels are attached, each of which contains four tangent springs so arranged as to keep the chains taut and to receive the first impulse in starting. The action of the springs is to allow a certain amount of relative motion between the two axles, thus avoiding the hard driving action experienced when both axles are rigidly geared to one motor. The whole tractive power is utilized without rigidity. This, in connection with the power of using the fly wheel momentum of the motor, is deemed a valuable feature, as the necessity for two motors is obviated.

Electric Roads and Telephones.

The struggle between ground and metallic circuits has broken out with renewed vigor in England, where the claim of the telephone companies that they own the earth seems more likely to be admitted than here. The decisions in this country in favor of the railroads are familiar to our readers. The English Telephone Company and the Weston-super-Mare Tramway had a skirmish before a select committee of the House of Commons recently. The Telephone Company applied for a clause to bind the Tramway Company not to disturb existing or future telephone lines. The Tramway Company objected to this, as it would necessitate an insulated return, instead of the rails. They offered to put up metallic returns to the existing telephone circuits if the Telephone Company agreed to do so in erecting future lines; surely a most liberal proposition from the American viewpoint. The Telephone Company wanted to continue their use of the earth return in existing lines, and to secure it for future lines without disturbance. The Tramway Company called Mr. S. Sellon, their engineer, who gave evidence as to the cost of insulated returns for tramways and telephones, and Mr. J. Swinburne, who gave electrical evidence. The telephone company called Sir W. Thomson, who held that it was not fair for the telephone company to be debarred from free use of the earth return in future. Sir Frederick Bramwell and Dr. Hopkinson were ready to corroborate his evidence, but the committee discouraged further testimony. The committee finally inserted a clause whose meaning is enigmatical. Apparently they have been not only eager to prevent the telephones being disturbed by the tramways, but they have also taken measures to guard the tramways from being disorganized by the intrusion of telephone currents. It is hoped that this bill may come before a strong committee in the House of Lords, so that a clause doing justice to both sides can be inserted which may become a good precedent. The matter is of enormous importance to tramway and telephone companies; but the eventual solution is in America believed to be the universal adoption of metallic circuits for telephones.

A New Underground Trolley.

With all the plans for electric street cars desiring current from underground conductors, the difficulty thus far has been to secure an insulated position for the wire; in other words, to devise a conduit which would be so perfectly dry as to prevent the grounding of the current in bad weather. The accompanying figure illustrates the solution of this difficulty, proposed by Mr. Ernest M. Reed, of Wichita, Kansas, showing the motor car in position on the



REED UNDERGROUND TROLLEY SYSTEM.

track, connected, through the medium of a conduit carriage, with the electric circuit lines in the conduit.

Mr. Reed has provided in his system a conduit of the form represented in the illustration, which has a double arched interior, and a surface slot, oval in cross section. The frame work of the conduit consists of a series of equidistant yoke frames of cast iron, and the walls and bottom thereof between the yoke frames are of masonry or concrete, preferably the latter, and the sides of the surface slots are provided with longitudinally arranged concave plates secured to the yoke frames. The entrance of the surface slot is provided along each side with iron bars or plates, and the shoulders of the yoke frames provide seats upon which the stringers of the motor car track are laid.

Within the conduit is a carriage track supported on cast iron brackets, detachably socketed in the yoke frames along each side of the conduits, thus leaving the conduit bottom

and centre unobstructed. Suspended by means of non-conductor hangers from each side arch are the electric circuit lines, positive and negative. Arranged upon the track in the conduit is a carriage, provided in the middle with an upright column hinged to the carriage so that it may turn laterally, and extending up through the conduit slot; and the column is centrally and vertically recessed, and in this recess is arranged a connecting wire protector for conducting and protecting the positive and negative wires which are used for connecting the motor with the underground system.

The motor car has attached to it a hinged socket cap, operated by means of a lever, which is for the purpose of

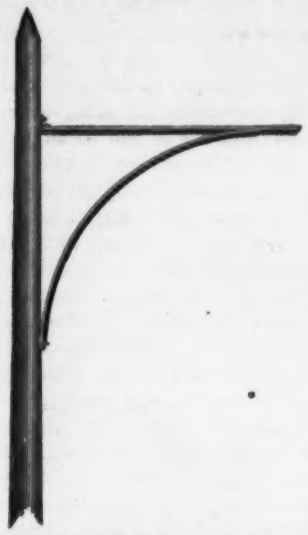


FIG. 1.—ELECTRIC RAILWAY BRACKET.

connecting the car with the upper extending end of the conduit carriage column, and is so arranged as to be connected or disconnected from the column by operating its lever. In operation, when the motor car advances it advances the conduit carriage with it by means of the column and socket connection.

Mr. Reed has provided for switches and connections in his system which are of a simple nature, and as a whole his invention deserves praise for the care with which all its details have been worked out.

Details of Electric Railway Construction.

As the details of the latest type of electric railway appliances are of much interest and importance, we illustrate on this page the angle iron brackets and the pole ratchets now being used on a large number of electric roads. The bracket, Fig. 1, which is made of wrought iron piping, can be used on either wood or iron poles, and presents a neat appearance, while at the same time it is unusually strong and durable.

The ratchet, which is shown in Fig. 2, is intended to be placed at the top of either an iron or wooden pole. The bolt passes through the pole and is secured by the nut at the back. The span wire is attached to the ratchet wheel, and can, by turning the wheel with a wrench, be raised or lowered, or can be so adjusted that the trolley wire will

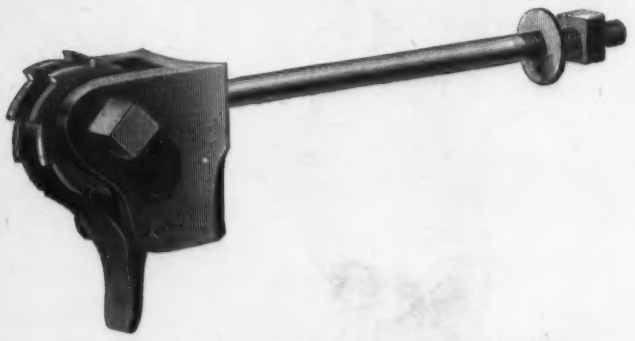


FIG. 2.—POLE RATCHET FOR RAILWAY SPAN WIRES.

hang directly over the centre of the track. The Electric Merchandise Company, of Chicago, is placing these appliances upon the market.

On Huygens' Gearing in Illustration of the Induction of Electric Currents.*

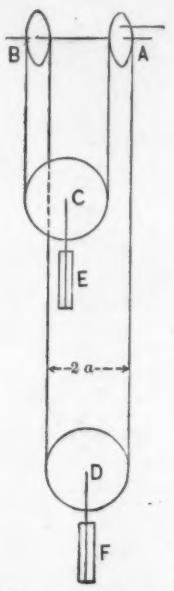
BY LORD RAYLEIGH, SEC. R.S.

As a mechanical model of the electric machinery at work in the induction of currents Maxwell employed differential gearing; and an apparatus on this principle, designed by him, is in use at the Cavendish Laboratory. Wishing to show something similar in a recent course of lectures, and not having differential gearing at my disposal, I designed more than one combination of pulleys, the action of which should be analogous to that of electric currents. These eventually resolved themselves into Huygens' gearing, invented, I believe, in connection with the winding of clocks. As this apparatus is easier to understand than differential gearing, and the parts of which it is composed are more likely to be useful for general purposes in a laboratory, I have thought that it might be worth while to give a description, accompanied by an explanation of the mode of action.

Two similar pulleys A, B, turn upon a piece of round steel fixed horizontally.† Over these is hung an endless cord, and the two bights carry similar pendant pulleys C, D, from which again hang weights E, F. The weight of the cord being negligible, the system is devoid of potential energy; that is, it will balance, whatever may be the vertical distance between C and D. Since either pulley A, B, may turn independently of the other, the system is capable of two independent motions. If A, B, turn in the same direction and with the same velocity, one of the pendent pulleys C, D, rises and the other falls. If, on the other hand, the motions of A, B, are equal and opposite, the axes of the pendent pulleys and the attached weights remain at rest.

In the electrical analogy the rotatory velocity of A corresponds to a current in a primary circuit, that of B to a current in a secondary. If when all is at rest the rotation of A be suddenly started, by force applied at the handle or otherwise, the inertia of the masses E, F, opposes their sudden movement, and the consequence is that the pulley B turns *backward*, *i. e.*, in the opposite direction to the rotation imposed upon A. This is the current induced in a secondary circuit when an electromotive force begins to act in the primary. In like manner, if A, having been for some time in uniform movement, suddenly stops, B enters into motion in the direction of the former movement of A. This is the secondary current on the break of the current in the primary circuit.

It must be borne in mind that in the absence of friction there is nothing to correspond with electrical resistance, so that the conductors must be looked upon as perfect. The frictions which actually enter do not follow the same laws



MECHANICAL ILLUSTRATIONS OF INDUCTION.

as electrical resistances, and only very imperfectly represent them. However, the frictions which oppose the rotations of A and B have a general effect of the right sort; but the rotations of C and D, corresponding to dielectric machinery, should be as free as possible.

The effect of a condenser, to which the terminals of one of the circuits is joined, would be represented by a spiral spring (as in a watch) attached to the corresponding pulley, the stiffness of the spring being inversely as the capacity of the condenser. The absence of the spring, or (which comes to the same thing) the indefinite decrease of its stiffness, corresponds to infinite electrical capacity, or to a simply closed circuit.

The equations which express the mechanical properties of the system are readily found, and are precisely the same as those applicable in the electrical problem. Since the potential energy vanishes, everything turns upon the expression for the kinetic energy. If x and y denote the circumferential velocities in the same direction of the pulleys A B, where the cord is in contact with them, $\frac{1}{2}(x+y)$ is the vertical velocity of the pendent pulleys. Also $\frac{1}{2}(x-y)$ is the circumferential linear velocity of C, D, due to rotation, at the place where the cord engages. If the diameter be here $2a$, the angular velocity is $(x-y)\div 2a$. Thus, if M be the total mass of each pendent pulley and attachment, Mk^2 the moment of inertia of the revolving parts, the whole kinetic energy corresponding to each is

$$\tfrac{1}{2}M\left\{\frac{(x+y)^2}{4}+\frac{k^2}{a^2}\,\frac{(x-y)^2}{4}\right\}.$$

For the energy of the whole system we should have the double of this, and, if it were necessary to include them, terms proportional to x^2 and y^2 to represent the energy of the fixed pulleys. The reaction between the pulleys, A, B, depends upon the presence of a term xy in the expression of the energy. We see that this would disappear if $k^2=a^2$, as would happen if the whole mass of the pendent pulleys and attachments were concentrated in the circles where the cord runs. The case discussed above, as analogous to electric currents, occurs when $k^2<a^2$, a condition that will be satisfied, even without non-rotating attachments, if the cord run near the circumference of the rotating pulleys. The opposite state of things, in which $k^2>a^2$, would be realized by carrying out masses beyond the groove, and thus increasing the rotatory in comparison with the translatory inertia. In this case the mutual action between A and B is reversed. If when all is at rest A be suddenly started, B moves forward in the *same* direction. Otherwise C and D would have to rotate, and this in their character of fly-wheels they oppose.

Generally, if L, N be the coefficients of self-induction, and M mutual induction, we have (constant factors being omitted)

$$L=N=a^2+k^2,$$
$$M=a^2-k^2.$$

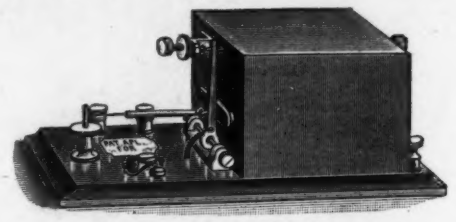
In order to imitate the case of two circuits coiled together in close proximity throughout, we must have in the mechanical model $k^2=0$; that is, the rotatory inertia of the pendent pulleys must be negligible in comparison with the translatory inertia. Also the energy of the fixed pulleys, not included in the above expressions, must be negligible. If these conditions be satisfied, a sudden rotation imposed upon A generates an *equal* and opposite motion in B.

* *Phil. Mag.*, London, communicated by the Physical Society.

† Light wooden laths, variously colored and revolving with the pulleys, render the movements evident at a distance.

Carr's Automatic Adjuster for Telegraph Lines.

This instrument is for use in improving the working of a telegraph line in heavy weather. Its action is automati-

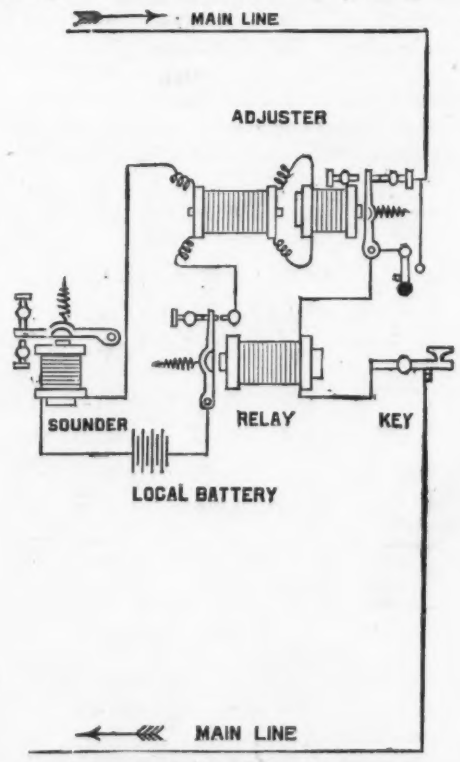


TELEGRAPH LINE ADJUSTER.

cally to open the wire for an instant whenever any key on the circuit is opened.

The adjuster is composed of an electro-magnet of a certain construction, which is arranged to influence an armature having an adjustable spring. The spring holds the armature back on a contact point. The armature and the contact point lead to separate binding posts by way of a common two-point switch which is used when desired to cut out the points. The electromagnet itself is connected in series with the secondary wire of a properly made induction coil. The two ends of the primary wire of the coil lead to the other two binding posts.

The office connections are very simple. The main line is brought to the two binding posts of the adjuster that lead to the contact points. The other two binding posts are connected with the local circuit of the relay that the operator uses for business. This connects the primary wire of the induction coil into the local circuit, in series with the sounder and local battery. Two or three additional cells should be added to the battery to insure good results. The spring that controls the armature of the adjuster should now be regulated, so that an opening in the local circuit of the relay will cause



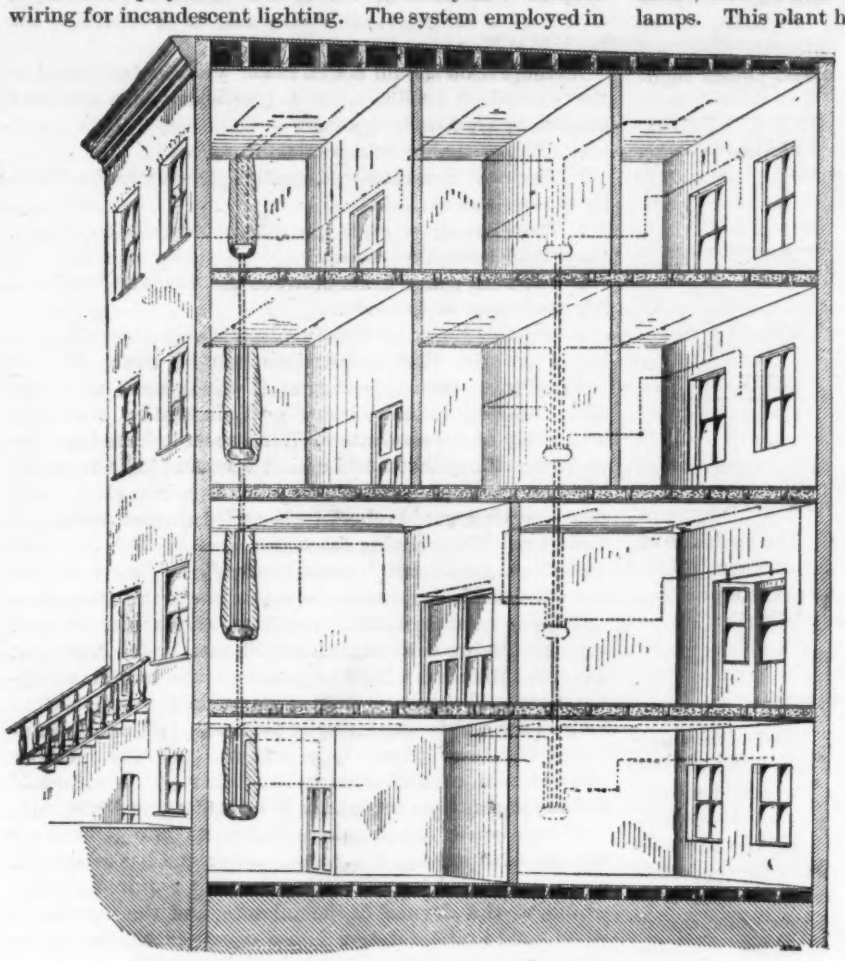
CONNECTIONS OF LINE ADJUSTER.

a momentary "kick" of the armature on the adjuster, but a closing will not affect it. This is easily done, as an opening produces a much stronger effect on the armature than a closing. The relay that the operator works on should now be adjusted for the most distant office, or the next office having the device. When this is done there will be a "kick" on the armature of the adjuster whenever a key opens at any point on the circuit and none when it closes. When this "kick" occurs, and the switch is open, it breaks the circuit in the main line. The desired length of time for the circuit to be broken is obtained by regulating the play of the armature on the adjuster by its set-screw; a very short break, however, is all that is necessary. The switch is simply to use in cutting out the breaking points, when desired; it does not cut out the coil itself, as that is not desirable. After once being adjusted there is no variation in the action of the adjuster, unless the strength of the local battery

is altered. It is claimed by Mr. Carr, the inventor of this instrument, that a circuit properly equipped with adjusters and with the relays at such points properly adjusted, will give all offices on the wire a comparatively clear working line in the heaviest weather.

Interior Wire Conduits.

The accompanying illustration shows the method of distribution employed in one of the latest styles of interior wiring for incandescent lighting. The system employed in



ARRANGEMENT OF INTERIOR WIRE CONDUITS.

the three-story and basement house shown in the cut is that of the Interior Conduit and Insulation Company. The experience which this company has had in this class of work has led to the establishment of centres of distribution at convenient and suitable points, from which all the branch circuits radiate. By this method it has been found that the most economical and efficient results can be obtained, and it is adopted in all first-class installations.

For mains and feeders the company advises a separate tube for each conductor, in which a rigid wire of either underwriters' or a weather-proof insulation may be employed, but for branches a flexible twin conductor enclosed in a single tube is always recommended. It will be seen from the diagram of the house that, by employing as many risers as possible, long lateral extensions are avoided.

Domestic Electric Lighting.

BY W. A. STADELMAN.

In THE ELECTRICAL WORLD of July 12, 1890, I notice an article on a small electric lighting plant, and in the editorial notes it is said to be strange that more is not done in this country toward domestic electric lighting. I do not know what has been done in this direction in other parts of the country, but I think that the suburban residences of Philadelphia have certainly gone into private electrical enterprises on a very extensive scale.

Mr. Frank Thompson, First Vice-President of the Pennsylvania Railroad, takes a great interest in everything electrical, and has the largest individual plant of the kind at his country residence, Merion Station, that I know of; it is of about 400 lights capacity, and these are distributed throughout his house, stable and grounds. Mr. Thompson's plant consists of a 25 h. p. New York Safety steam engine and boiler and Edco dynamo, made by the Electro Dynamic Company, of Philadelphia, who installed the plant, and 200 15-L cells of accumulator, made by the Electric Accumulator Company, of New York. The lamps burn at 110 volts, and several motors for various purposes are in use. A separate building is used for the engine and dynamo, but the accumulators are in the cellar of the house. A regular engineer is in charge of the plant night and day.

Mr. A. J. Cassatt, also of the Pennsylvania R. R., has a very complete private plant at his residence near Haverford College, Pa. Mr. Cassatt has a 20 h. p. engine and boiler, and 200 cells of accumulator and 250 incandescent lamps. This plant has been in very successful use for over three years, and has been managed entirely by Mr. Cassatt's gardener.

Mr. W. W. Griscom, President of the Electro Dynamic Co., has a plant at his residence in Haverford; a 15 h. p. steam engine and boiler and dynamo in the stable charge the batteries in the cellar of the house. The steam from this plant is also used for heating the house in winter. Mr. Griscom's gardener runs the plant very successfully, and it has been in operation for three or four years.

At Ashbourne, another suburb of Philadelphia, Mr. John B. Stetson, the hat manufacturer, has quite an extensive plant which has been in operation lighting his residence for over two years; a 10 h. p. engine, boiler and dynamo charge the storage batteries; the whole plant is in the gardener's hands, who runs it very successfully.

At Media, Pa., Mr. R. W. Downing, of the Pennsylvania Railroad, has a small private plant, but no storage batteries. He has a Westinghouse engine and dynamo and about 50 lights capacity.

At Germantown, Philadelphia, Pa., Mr. James A. Wright has a private plant, with accumulators, a 5 h. p. engine and Edison dynamo of about 50 lights capacity.

I have running at my house at Bala what I consider one of the most complete private plants in this country. It consists of a 6 by 6½ Westinghouse engine, 12 h. p. Shapley boiler; a 60 ampère, 75 volt Edco dynamo, with 38 cells of 15-L electric accumulators and 33 cells of 23-C electric accumulators. This plant supplies current for about 155 16 c. p. Sawyer-Man lamps and six motors, one 1 h. p. Sprague motor, running a shop; one ½ h. p. Sprague, running laundry; two ⅛ h. p. Perret motors, running fans, and two ⅛ h. p. Griscom, running sewing machine. We have one simplex arc on the lawn during the summer to attract the bugs. This plant has been in operation for nearly two years, and has never yet given the slightest trouble from any cause. The boiler furnishes steam for pumping, besides running the engine, and uses about 1½ tons of pea coal a week, at a cost of $3.75. The repairs on the entire plant have been little or nothing, and give no trouble whatever. We think the light is cheap, when we consider the volume of light and the satisfaction.

Besides the above private plants I know of at least a half dozen more in this vicinity, of various sizes, mostly smaller ones, with and without accumulators, and all giving the greatest satisfaction; and I do not know of a single case in which the owners consider it a nuisance to run the engine and charge the accumulators.

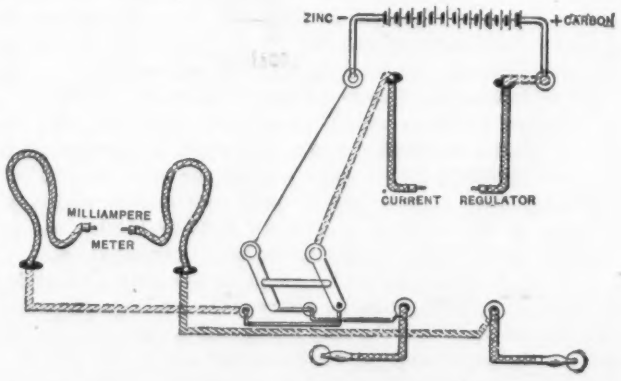


FIG. 1.—CONNECTIONS IN MEDICAL APPARATUS.

Some More Long-lived Lamps.

Reports of incandescent lamps whose life runs up into the several thousands continue to reach us from many different parts of the country, and there is every reason to believe that the longevity of lamps is gradually but surely being increased; so that what now appear to be phenomenal records may in a few years become commonplace. Theoretically, it is not easy to set a limit to the improvement possible in this direction; and as our reports concern lamps of all the different manufacturers it is evident that all are striving, with almost equal success, to achieve perfection.

A very notable case of lamp endurance comes to us from Albany, Georgia, where, in a restaurant using nine 32 c. p. lamps and one 50 c. p., but one new lamp has had to be put in for a year and a half, or during an actual lighting of 3,500 hours. If this record is authentic, the lamps in question certainly deserve their name of "Edison High Economy;" but Mr. C. G. Barfoot, who sends us the facts, does not mention the voltage used. A slight variation from nominal voltage explains many phenomenal records.

Some Electro-Medical Apparatus.

The medical uses of electricity have not increased with the immense rapidity that has characterized the growth of electrical arts generally, but still time has made great changes. The electric battery and the induction coil have gradually passed from being dangerous playthings in the hands of quacks to being useful tools of the physician and surgeon. Probably electro-therapeutics will show considerable advance in the next decade for it has now passed into the scientific stage of its development. We show in the accompanying cuts several convenient adjuncts to the medical battery. Fig. 2 shows the Bailey current regulator, which is a simple and convenient form of the well-known liquid reheostat specially designed for physicians' office use. It consists, as is easily seen, of two sets of carbon plates, each set insulated from the other and connected to a binding post. On lowering the plates into the water by the rack shown in the cut, the resistance between the plates is very nicely regulated, and the current from the battery may be varied at will. The range of resistance is very great—from twenty ohms to two megohms. With the current regulator is shown a simple and sensitive form of milli-ampère meter, which enables the operator to adjust his current to any desired strength. Both instruments are made by the Law Telephone Company, of New York, well known as the makers of an excellent form of the Leclanche type of battery. Batteries and regulating apparatus are often supplied together for physician's use, and Fig. 1 shows a complete diagram of the connections employed. Of course the battery of many cells is only employed in certain classes of medical work, the induction coil being largely used; but still some standard battery and proper regulating and measuring apparatus find a place in the offices of a very large number of medical men.

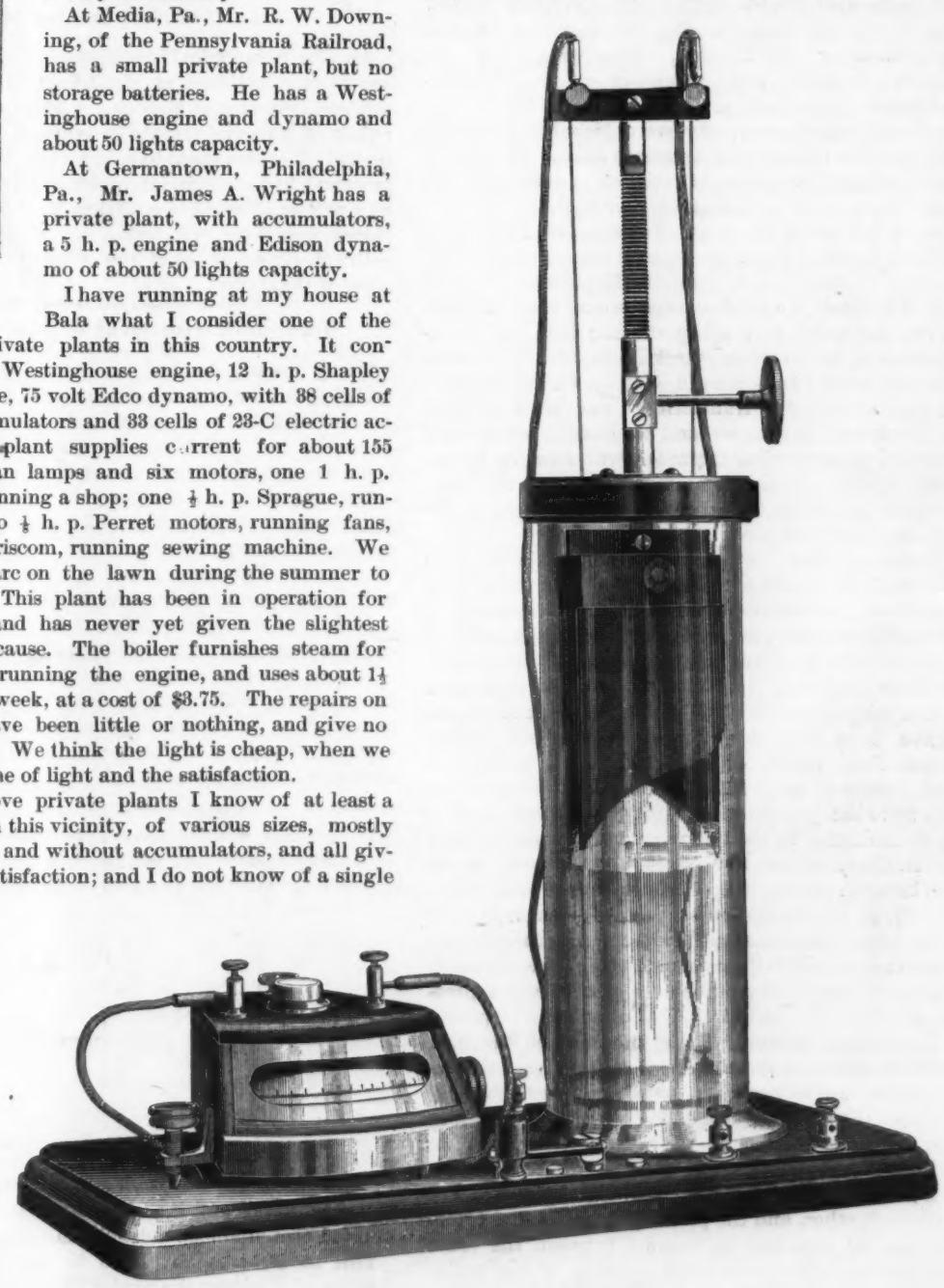


FIG. 2.—BAILEY CURRENT REGULATOR.

Electrical Distribution by Transformers from Central and Eccentric Stations.*

BY DR. S. A. FLEMING, M. A.

§ 1. *Transformer Systems.*—The employment of the alternate current transformer for electric current distribution has changed in many respects the practical possibilities of the supply of electric energy for lighting purposes in large towns and in districts in which great distances, comparatively speaking, separate the centres of consumption and supply. By its aid it has become possible to deal with problems in electric distribution which are less amenable, or, perhaps, commercially speaking, unprofitable, when attacked by other methods; and its enormous extension in six or seven years in Europe and America is in itself evidence of the utility of the method.† In examining the results as a whole that have been obtained by the employment and adaptation of the transformer for this purpose, we shall proceed to describe the principal systems at work, and the details of the installations of transformer systems in typical places in which it has stablished itself as a fit solution of the practical difficulties which there presented themselves to be overcome. The systems now occupying positions of importance, and on the lines of which, in different places, electric distributions of varying degrees of magnitude are being carried out, are chiefly those connected with the names of Ganz & Co., of Budapest, operating the methods of Messrs. Zipernowsky, Déri, and Bláthy; the Westinghouse Electric Lighting Company, and the Thomson-Houston Electric Lighting Company, in the United States, operating the systems elaborated by the well-known inventors connected with them; in England, the now familiar systems of the London Electric Supply Corporation (Mr. S. Z. de Ferranti), the Brush Electrical Engineering Corporation (Mr. Mordey), and the House-to-House Electric Lighting Company (Messrs. Lowrie, Hall, and Parker). The Metropolitan Electric Supply Company of London, employing for the most part methods and machines of the Westinghouse Electric Light Company, as well as Elwell-Parker dynamos and transformers, may be considered as a connecting link between English and American ideas. This list by no means exhausts the names of designers or manufacturers of transformers, or of their necessary adjunct, the alternating dynamo. Apart from efforts of pioneers we have excellent designs for these separate elements connected also with the names of Messrs. Siemens, Gramme, Hopkinson, Goolden, Kapp, Wilde, Snell, Swinburne, Sharpe and Kent, Elwell-Parker, R. Kennedy, and many others; but the above-named six or seven complete systems comprise for the most part the best known apparatus in wide use for the distribution of electric energy by transformers, and some account of the machines, appliances, and methods in use by each respectively, taking typical examples, will now be given. The order in which they will be mentioned has, however, no reference to their historical order of development, nor to their relative importance.

§ 2. *System of Ganz (Zipernowsky, Déri and Bláthy).*—The methods of transformer distribution that have been elaborated and put into execution by the inventive ability of Messrs. C. Zipernowsky, M. Déri and O. T. Bláthy, of Budapest, have enabled the great firm of Ganz & Co. to establish a special electric lighting department and to undertake on a large scale the production of all the appliances and details that have been worked out into the complete system that bears their name. Nearly 70 central stations of different degrees of magnitude have been set in operation by them up to the present time (1890), in which electric energy is distributed to arc and incandescent lamps from central stations, about 1,000 arcs and 100,000 incandescents being in all supplied. The elements of this system comprise (i), an alternating-current dynamo machine; (ii), an exciting continuous-current dynamo; (iii), the alternating transformers, and (iv), special regulating devices, which have for their object the maintenance of a constant pressure, irrespective of consumption, at some point or points in the distributing system. The system may be described as a *parallel* system in its entirety, that is to say, the exciting dynamos are arranged in parallel between two exciting mains, the field magnets of the alternating dynamos being in parallel between the same mains (see Fig. 1). The armatures of the alternators are arranged in parallel between a pair of primary mains, working, if need be, in step with each other, and the primary coils of the transformers are all arranged in parallel between the same primary mains. The secondary circuits of the transformers are arranged in parallel with the lamps between the same secondary mains. The exciting dynamos are shunt dynamos, and the field-magnet circuits of these dynamos are also all arranged in parallel and take currents off the main circuit of the exciting dynamos, into which the armatures of the exciters are as well all joined in parallel. There is a variable resistance interposed in the circuit of all the fields of these exciters, by the variation of which the strength of the exciter field can be varied, and hence the electromotive force of the exciters. The field-magnet circuits of the alternators being all joined in parallel with each other, and with the armatures of the exciters, it is obvious that the variation of this intercalated resistance can be made to change the strength of field of the alternators, and hence the electromotive force of these machines within certain limits. The transformer circuits are joined in parallel between the primary and secondary mains. From some points in the secondary distribution system, which may be called the electrical centre of the network, a pair of voltmeter wires can be brought back to the station, and by an arrangement presently to be described the regulating resistance can be properly varied so as to keep the electric pressure at this electrical centre of distribution constant. Voltmeter wires, or *feeling wires*, may be brought back to the station from more than one point, and the pressure at any one of these points regulated as the demand for current requires. The variation of one resistance controlling the field of the exciters, therefore, is able to effect the regulation of the electric pressure in the secondary circuits over large areas of distribution.

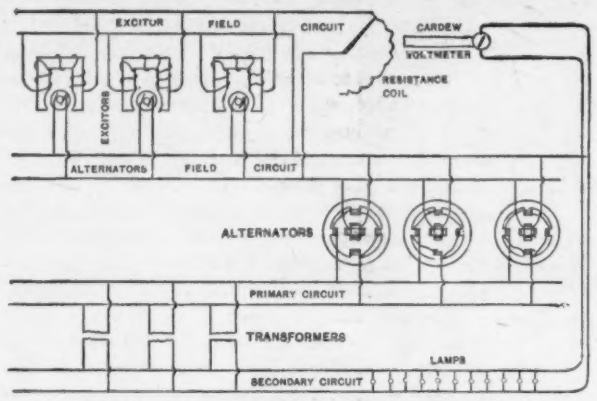


FIG. 1.—GANZ SYSTEM OF TRANSFORMERS.

(*To be continued.*)

*From *The Electrician*, London.

† The arguments *pro* and *con* in the case of alternate transformers and secondary batteries for central station electric lighting need not be entered into here: but we refer the reader to Mr. R. E. Crompton's excellent Paper, and the discussion thereon in the *Journal of the Institution of Electrical Engineers*, Vol. XVII., 1888.

An Electrical Testing Station.

An electro-technical testing station for North Germany has been established at Magdeburg, on the lines of the similar institution at Munich. Experiments and tests for public officials and private individuals will be there conducted, to enable them to gain a clear idea of the cost and practicability of electrical undertakings, and the opportunity will be afforded to electrical works to have their machines, apparatus, etc., tested. A well-known electrician —Dr. M. Krieg, editor of the *Elektrotechnisches Echo*—is chief of the station.

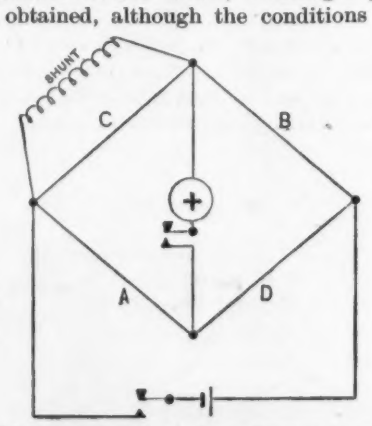
Accurate Measurement of Low Resistances.

Every one who has had occasion to use the Wheatstone bridge, with the mirror galvanometer, for the purpose of measuring small resistances has suffered from the inconvenience and difficulty consequent on inexact balance, even when unequal arms are used.

Recently finding it necessary to obtain a very accurate adjustment with the bridge, with arms of equal resistance and not exceeding 100 ohms each, the minute differences of resistance existing between the arms, although nominally equal, rendered an accurate balance impossible.

The use of fine wires, sliding contacts and various other devices were tried, without any satisfactory result.

It then occurred to me to shunt one of the higher resistance arms with an adjustable resistance very much greater than itself, and this was found to be perfectly successful; alterations of the shunt, enabling a perfect balance to be obtained, although the conditions were such



MEASUREMENT OF LOW RESISTANCES.

that a difference of $\frac{1}{100000}$th in the joint resistance of the shunted arm produced a deflection of one divison.

This mode, says Mr. Eden in the London *Electrical Review*, of attaining the condition of perfect balance has no doubt suggested itself to others, but does not appear to have been published before and it may be of service to draw attention to it now.

It is clear that it is not only useful in attaining a perfect balance with some predetermined fixed resistance, but may be employed in the exact determination of small fractions of an ohm which are now less accurately estimated by using arms of unequal resistance.

If determinations to $\frac{1}{1000}$, $\frac{1}{10000}$ or $\frac{1}{100000}$ are required, the shunt should be respectively 1,000, 10,000, or 100,000 times the arm resistance, and it may be used to determine a resistance which by that amount is in excess of, or is less than, the resistance unplugged in the measuring arm.

For *plus* results in *D* the shunt should be placed across the arm *A*, and for *minus* results across the arm *C*; and it will be found in practice that this method admits of very exact measurements with great ease of manipulation.

Notes on the Differences Between English and American Electric Lighting Accessories.

BY FRED. BATHURST, ASSOC. INST. E. E.

Having had the advantage of gaining an intimate knowledge of the methods of construction and the electric lighting accessories in general use at the present time in England, I have naturally endeavored to compare the ways and means that appear to have been generally adopted with those prevailing in England, and it is hoped that the few remarks that follow may be of interest to the readers of THE ELECTRICAL WORLD.

A comparison should not be made without due regard to the prevailing conditions, and I consider that the chief conditions are four in number:

1. Climatic and characteristic differences.
2. The more general use of electric lighting in the States by the less moneyed classes.
3. That wiring work in the States is mostly done on a "centre distribution system."
4. The keen competition between the three or four leading companies in America.

As regards No. 1, an English electrician's first feeling is one of surprise that installations can be run at all; for, judging from first appearances, it would seem that very little trouble is taken to insure good insulation resistance and safety of the conductors. Wires seem to have been put up just in the quickest and easiest way, and little attention has been given to appearances; in fact, wires often sadly disfigure what would otherwise be called elegant rooms and buildings. Upon asking the reason, one is told that the American electrician "must hustle;" he has not time to "wait and look round;" he wants to get the work done and his account collected. The American is correct, and he is complying with natural conditions; for the American general public is not hard to please in the matter of appearance, and the ways and means are not questioned so long as the end is satisfactorily obtained. Climatic differences operate to a very large extent, and the methods adopted here, even if permitted on other grounds, would fail in England, on account of low insulation resistance.

2. As electric lighting here has come into general use among small stores, saloons, etc., a demand has arisen for cheap work, and artistic fittings are not required; while, owing to the dryness of the climate and the amount of wood used in the interior house construction, the cheap open cleat work with wires run in sight upon the varnished deal ceilings is quite a usual construction, and must evidently give satisfaction, both from the companies' and consumers' point of view. This condition has, I consider, had a great effect upon fittings and accessories as tending rather to encourage inferior finish and construction, the idea being that low cost of production is all-important. In England we have not reached the time when power supply companies will install the wires gratis, and the cost of current alone renders lighting a comparative luxury, so that all work is carried out in the better class of house or store, where the owner is prepared to pay a high price for its installation, and paying this price, he naturally becomes very exacting as to the appearance of the work and fittings. This condition, coupled with strict fire office rules (almost exacting, from the free American point of view), has combined to improve both the appearance, design and construction of English accessories and installation work.

3. The "centre distribution" method of wiring seems to be preferred by American electricians, presumably because of the labor saved, as this system is easily and rapidly installed where the work is done on one floor and long "runs" can be obtained and a conspicuous duplication of wires is no objection. It is urged that a more even potential is obtained by this method, but I believe only from an extra expenditure in copper, for in most cases the "free system" (general in England) gives just as even distribution with a smaller *total* weight of copper installed. The question here is whether copper is not cheaper than labor, for a free system requires additional labor in tapping on the many small distributing branches, and American labor being expensive, it is cheaper to work on a centre distribution system and pay for the extra weight of copper used. A centre distribution system also effects a saving in the number of branch and fuse blocks, not so many different sizes being called for in construction.

4. Owing to the keen and to a certain extent injurious competition existing between the leading companies (each of which has the only successful system) in the desire to bring out and perfect its main features, the details have to some extent been ignored or left to others to perfect or those adopted which have low first cost. Perfection in details can effect great savings in labor and petty annoyances, and often it is the apparently trivial improvements that make all the difference. An ample margin should always be allowed in wiring estimates for accessories, as, owing to the inherent difficulty in exact estimating, it will be found (in the majority of cases) that the actual cost is rather over than under the estimated cost.

Wires.—As regards insulation, usage in America would seem to favor certain preparations and admixtures of rubber in preference to pure Para rubber, it being found that the dry air and heat has a withering effect on pure rubber, causing it to dry out and develop cracks.

An addition of certain well known materials, such as sulphur, Trinidad pitch, etc., seems to have a beneficial effect and give a longer and more satisfactory life, while it affords an efficient insulation resistance. The dampness

of the English atmosphere acts injuriously on a rubber composition, causing chemical changes and eventually destroying the necessary qualities of mechanical strength combined with insulation. A compromise has accordingly been made and the construction now finding general favor is a thick coat of pure rubber on a tinned or cotton-coated copper wire, over which is served a double layer of cotton. A prepared rubber mixture is then applied, and this is served with a lapped or preferably braided coating of cotton. The wire is then passed through the vulcanizing chamber and finished by being drawn through some tar compound. Positive wires are often soaked in a red lead compound, so that the color will form a means of distinguishing them from the negatives, as in practice there are many cases when this difference in color saves time and testing. I would mention that some users complain that the red wire is inferior to the black in point of life and insulation resistance.

The cables used in England for interior wiring work have an average insulation resistance from about 750 megohms (used in good dry positions, between joists, etc.) So 5,000 megohms per mile (used, say, for molded work in plaster), and the corresponding small wires and leads would vary from 150 to 500 megohms per mile.

American wire manufacturers do not appear to lay so much stress upon the actual tested electrical figures as upon the *thickness* of the insulation. To purchase wires according to the *thickness* of the insulation would be considered somewhat odd in England. But the American has an advantage over the English wire manufacturer, inasmuch as he has not to carry such a large and varied stock of sizes, for, owing partly to experience and convenience on the one hand and fire office restrictions on the other, no *solid* wires of a larger diameter than No. 16 B. W. G. are being used in construction work, the required sectional area being obtained by stranding a number of fine wires (3, 7, 19, 37 are the numbers generally found in a strand); and a certain sectional area can either be obtained by stranding 7 wires, or 19 of a smaller diameter, which gives rise to a duplication of stock, for one contractor prefers 7 strands, another the 19 strand cable. Some six or eight different gauges are amply sufficient for ordinary work done on a "centre distribution" method, but many more are asked for when the "free distribution" is used.

Restrictions as to insulation resistance are far more rigid in England than here, for every building wired for electric light is tested and must be approved by both the company supplying the current and the insuring fire officer, and all work must come up to a predetermined standard insulation resistance, usually

2.00	megohms	for a	25	light	installation.
1.25	"	"	50	"	"
0.75	"	"	100	"	"
0.5	"	"	150	"	"

here, although, of course, the better installations are tested for actual figures with a bridge and galvanometer. The magneto bell test seems to be in pretty general use for ordinary work, and it is needless to say that only the roughest idea can be gained by this method and the magneto only "speaks" when something is radically wrong. I have endeavored to obtain actual figures for the open cleat work prevalent here, but have not been able to collect sufficiently exact data to form a comparison. Any one having such figures would do well to publish them, as they would throw a great deal of light on the relative conditions of working.

Switches.—It is supposed that every electrician has at some period of his career improved, designed or invented an electric light switch, and consequently the class and type of the *genus* switch is legion, and the difficulty of making a comparison is greatly increased; but two or three general points of difference can be seen between English and American switches.

1. Double pole switches are used to a much greater extent here, and are evidently a step in the right direction. Even small 5 and 10 ampère switches are designed to break both poles at once, and in spite of the mechanical difficulty of making a small, neat and efficient form of D. P. switch American manufacturers have evidently tackled the problem seriously and obtained satisfactory results.

2. Switches that snap *on and off* are generally used here. While no one will question the advantage of the "snap off" and its partial elimination of the spark, the advantage of the "snap on" is not so apparent; it prevents children or others from "playing with" and "arcing" the switch so as to obtain the "pretty blue arc," which may possibly destroy the contact surfaces; but on the other side, the mechanical construction to properly effect this object is imperfect, intricate or clumsy. A *good* contact should be both a "grinding" and "sliding" one, and at present we have not this ideal in the "snap on" switch, for either the grinding (owing to the contact pressure) or the "sliding" and cleaning action is only partially carried out.

The mechanical devices finding general favor here are either "cam movements" or "springs working over centres."

3. Place an English type of switch beside the American and a glance shows a striking difference. The English one only attempts one-half what the American does, but has all the advantage in the matter of appearance, for it seems to have been well designed, with the fewest number of working parts, and has a solid, substantial look about it. The American, on the contrary, seems to contain many small parts, roughly finished and hastily put together, and has evidently had little hand work put on it. Perhaps it is unfair to compare two articles that do not accomplish exactly the same objects, but the illustration will serve to point out the noticeable point that in the English switch considerable attention has evidently been given to appearance.

4. In the smaller switches two sizes seem to be all that are required, while in England 3, 5, 10, 15 and 20 ampère switches are in general use.

Here switch socket holders are provided for nearly every lamp, while in English installation the switch for the room can nearly always be found just by the door, so that any one entering in the dark can immediately light up the room without grouping about for the fitting.

5. Many switches seem still to be fitted with wood bases, although generally provided with mica "flash plates." Dry wood is a very efficient insulator, easy to obtain and convenient to work, but is extremely liable to fire. In England slate or porcelain is in general use. Slate, when boiled in paraffine, after having been carefully selected, is fairly reliable, but some slates are far more absorbent than others, and slates from the same quarry often vary greatly in insulation resistance. English porcelain is a very satisfactory material for switch bases.

Fixtures.—In America the gas fixtures are generally used for the attachment of electric lamps and globes and in England their use is the exception, for owing to the general use of gas the centre of a room is usually occupied by the conventional gas fixture, which, while difficult to adapt, is still more difficult to insulate from earth, and fire officers discountenance the combination. The electrician therefore takes to the walls, and by putting in small ornamental brackets or pendant brackets secures a more even distribution of light with a prettier effect. People using electricity expect more light than from gas and look for something out of the ordinary, and a tendency has thus arisen to make electric fixtures as different in design as possible from gas fixtures.

A detail in construction that is generally used here and much wanted in England is the sliding canopy. English fixtures are without this convenience and are necessarily difficult to fix so neatly and quickly as could be desired.

Recently wrought iron and polished copper have come into extensive application in fixture work, and many effective combinations can be made; copper can be worked up into elegant floral designs, and it considerably enhances the appearance of an incandescent lamp. American manufacturers might do more with these materials.

American fixtures are generally made with "galleries" for carrying the shade; in England *shade carrying holders* are used on account of their being more compact and better and generally superior in appearance.

Lampholders.—A peculiar point of difference is apparent in the respective lampholders or sockets.

Here nearly all are designed upon the plan of having an inner central contact plate surrounded by an outer contact ring suitably insulated from it, and the lamp with cap to suit is either screwed or forced up into the socket. The usual English holder has two contact pillars which are mounted *side by side* on an insulating base. The pillars have spring contact plungers and make contact on two half-moon plates embedded in the lamp cap; the cap is fitted with small outside pins which engage in bayonet slots. This construction, although, perhaps, slightly more expensive to manufacture than the former, has one or two good points: first, that there is a greater certainty of contact, as the quarter turn (securing the pins in the bayonet slots) gives a rubbing and cleaning action while pressure is applied from the contact plungers; second, there is no tendency to *overturn* and break a lamp while inserting it, for the "snap" indicates when the lamp is securely fixed; there is also little chance of a lamp falling out of the socket.

Owing to the almost exclusive use here of switch socket holders, fixtures have to be placed within easy reach and are sometimes awkwardly low. The tap or switch handle makes a shade carrier on the socket inconvenient and a gallery preferable. A closed gallery looks heavy and clumsy, while an open one allows dust to collect on the lamp bulb. The English shade carrying holder is designed to take a shade with a 1¼-inch diameter hole, and the sliding sleeve fits the hole exactly, so that by its use a more graceful combination can be made and the disadvantages of the gallery excluded.

Lamps.—The monopoly of the lamp industry in England is a sore point with electricians as having caused users of incandescent lamps disgust and annoyance in various ways and prevented long-looked-for improvements in efficiency. On both sides the efficiency and life of a lamp seem about the same. A minor point is the difference in the shade of the bulb, and it is peculiar how different countries hold to their particular shape. America, England, France and Germany each favors a distinctive shape.

Fuse and Branch Blocks.—Some four or five sizes of branch blocks seem sufficient to fill all conditions arising in American construction work, mainly for the reason given under condition No. 3. In England the branch block used here is unknown because it is not applicable (at any rate from an artistic point of view) to molding work, its place being filled by two or three patented devices used in conjunction with a large number of fuse boxes which are usually circular in shape and of various diameters, and consist simply of two terminals with conveniences for fixing a fuse strip, mounted on a slate or porcelain base, with a brass or porcelain cover. American and English porcelain, although synonymous, are, in fact, very different; the former is vitreous and made in a similar manner to glass. English porcelain is in reality an earthenware (being made from an admixture of quartz clays) which, after being molded or turned to the required shape, is baked in a kiln. Its name arises from the fact of its superior white color and perfect glaze. English porcelain is undoubtedly much easier to work than American, and gives more highly finished work, is not so brittle, and there is no material difference in specific resistance. In these highly insulating materials *surface conduction* is of greater importance than the slight *interior* conduction.

The design of main cut-outs and double pole casing pattern safety junctions is virtually the same, the only difference being that in American practice there is a tendency to clamp the cable between two plain longitudinal surfaces in preference to passing it around a screw head under a washer. English practice is to cover up entirely if possible all metal parts on branch blocks, ceiling roses, fuses, etc., so that there is no possibility of obtaining a shock accidentally. Americans do not seem very particular in this respect.

In England magnetic cut-outs have proved very reliable and satisfactory, and are growing in favor. There must be an excellent opening in the American market for an approved form.

Ceiling Roses.—The American ceiling rose is not an artistic addition to a room for the reason that some metallic part is uncovered, from the fact that the feeding wire is connected up by clamping it in a jaw or similar device which must stand away from the base. This device, while facilitating erection, would not be permitted in England, where all connections of this sort are made by soldering on a small piece of wire, and bringing the insulation completely within the base.

In putting the above remarks before the readers of THE ELECTRICAL WORLD, I am aware that I render myself liable to comment from manufacturers and others who have apparatus designed for the particular cases, but I have endeavored to point out where the *general* differences are apparent without taking particular cases. Possibly I may have favored the English cause from my being better acquainted with it, but I would say that there are the limiting and controlling conditions to be considered in both countries; and while, perhaps, the American has not so much regard for appearances, he is evidently keenly *alive* to those devices that save time and money in erection. On neither side has the *ne plus ultra* been attained, and each can learn from the other, particularly as regards the above points.

As the main features of the different systems become better known, and the chief electrical problems solved, more and more attention is being bestowed on the minor accessories, and the system possessing the most carefully worked out details must eventually secure the lead.

The Application of the Law of Economy to Electrical Conductors.*

BY GEORGES SANTARELLI.

The final end of every technical research is to obtain from the materials used the best results possible; that is to say, to determine the conditions of their employment which give the greatest economy for a given amount of work. As it concerns the application of electricity and the transmission of energy by means of electric currents, the introduction of the principles of economy in the calculation of a system of conductors has been the object of many very interesting researches, particularly on the part of Sir William Thomson, Forbes, Blakesley, and numerous others. The theories developed by these authors in the formulæ which they have produced are well known to electricians, and have been explained in the technical press in a manner so complete that it is useless to mention them here. Nevertheless I have noticed that in all these researches the question is considered in a general way—in other words, the values of the various elements (resistance, diameter of wire, losses in transmission, etc.) considered—which enter into the study of any plan for utilizing electric energy, are looked at from the standpoint of general economy in both installation and operation. Doubtless this is the most general method of considering the question, and as it is, too, the most natural, one can easily understand why it has been so presented. But there are many times when it is desirable to confine the research to a more limited field and examine in detail one side or another of the question. For example, sometimes apparatus which will be but little used is put in, and in this case the most rational solution is to secure the maximum economy in installation. There are other cases when the elements which should enter into the calculation are not at all independent, and by reason of this the existing theories are not readily applicable. It is then useful to find the mathematical laws which enable us to calculate the conductors of a network, considered singly, or, still better, to define in various particular cases what will be the distribution with a given fall of potential which will give the minimum cost of material.

One can profit well by the analogies which are made in certain other questions relative to electricity by following a method quite similar to that developed in various hydro-dynamic discussions. In the calculations of conduits for water the formulæ for the best economy contains implicitly the known expression $T = K \frac{l Q^3}{d}$ deduced from the experiments of Darcy and Lavy, and which gives the laws of hydraulic potential Y found in a tube of length L and diameter D, with a flow Q per second. In the elec-

* *La Lumière Electrique.*

trical case the equations can be deduced from the known formula $e = i\,c - \frac{l}{d^2}$ which gives the laws of electrical charge nearly I on a conductor of diameter D traversed by a current I. As to the cost of the conductor in the hydraulic case we have the cost expressed by $P = \alpha\, l\, d$, calling α a specific coefficient depending on the material employed, and we assume up to the limit of the application of these formulæ of economy that we may consider as constant with reference to the diameter, the cost of labor and accessories. In electrical conductors, on the contrary, the price is represented for the most part by the weight of the metallic wire, consequently, if we take the diameter as the independent variable in the case of a bare wire, we can put rigorously $P = \beta\, l\, d^2$ (*a*); where B is a specific coefficient depending on the metal we can neglect the constant factors as labor, insulators, etc. In the case of insulated wires we may put $P = A\, l + \gamma\, l\, d^2$ (*b*); d being diameter of the interior conduit. These formulæ can be easily verified by comparing the prices of different contractors. This theory is confirmed by the study of a very interesting essay of M. Blakesley. Finally, in the case of conductors with elaborate insulation or with an exterior shield, such formula would become $P = B\, l + \lambda\, l\, d + \mu\, l\, d$ (*c*); but we find that the coefficient λ renders the term of the first degree with respect to d quite small compared to the sum of the other two. Only in the case of telegraphic cables, for which doubtless calculations of this sort would not have to be made, or for cables of peculiar construction would the term in λ have any considerable value. In any case an examination of the price of the various materials would enable us to judge whether the expression (*c*) should be replaced by another of the form (*b*). It is then this last case which we shall consider in the developments which follow. As the term l is supposed to be one of the given conditions of the problem, we may legitimately conclude that the only variables to be considered are the diameters. The quantity to be made a minimum in order to secure the best economy will be always $P = \Sigma\, l\, d^2$, the summation being extended to all the conductors which form part of the network which is to be calculated. It is to be noticed that the analogies with the formulæ employed in hydraulics would not lead us to accept completely the results which are obtained in electricity by a similar process. Indeed, it is clear that in anything which, for example, concerns the heating of conductors we shall have a limit to the values of d from the reason that we cannot pass a certain current density. This does not correspond to any case we are likely to meet in hydraulics, and it will, therefore, be necessary to make a rigorous determination of the conditions of application of these electrical formulæ, bearing in mind the heating. The analytical conditions of maximum economy can be found easily from an examination of the following general problem:

Calculation of a network of electrical conductors including any number of given points at different potentials. Let there be different sources of potential E_1 E_2 E_3 united by any system whatever of conductors.

It is proposed to carry the current to certain other points whether the potentials are e_1 e_2 e_3. We already know all the values of the potential at the extremities of the network, the lengths l of the different conductors and the intensities of the current in each. It is clear that if n is a number of conductors that compose a given network and m a number of nodes or points where two or more conductors meet, we should have only n equations of relation deduced from Ohm's law for each conductor in which would enter not only the n unknown diameters and the conductors, but also m unknown potentials belonging to the nodes. If then we propose to find a system of values of diameters d which will realize the conditions of the problem with respect to the potential and to the currents, we find the solution to be indeterminate.

(*To be continued.*)

Special Correspondence.

NEW YORK NOTES.

Office of The Electrical World,
167-177 Times Building, New York, July 21, 1890.

New York City's Lights.—According to Commissioner Gilroy's report, there are now 26,853 gas lamps, 872 electric lights and 138 naphtha lamps in use on the streets, parks, places, bridges and docks of the city.

The proposed electric road on Fulton street, New York city, has been abandoned. The cars will be operated by horses. The property at 232 and 234 Front street, has been purchased for stables. It was originally intended to equip this line with the conduit system.

Mr. Harry Baum, vice-president of the Fidelity Carbon Company, of St. Louis, and the energetic business hustler for the company, was in town all the past week. We regret to say that he was prostrated by the excessive heat on Tuesday, but his friends will be glad to learn that he has fully recovered.

Dr. George Bayles will attend the tenth International Medical Congress in Berlin as a delegate from the Medical Society of New Jersey. In behalf of Thomas A. Edison, Dr. Bayles will present to the Congress the results of some interesting electro-medical experiments which Mr. Edison has recently made.

The Brooklyn (N. Y.) Aldermen have received a report from the committee on lamps and gas recommending that a franchise be granted to the Brooklyn Electric Light and Power Company. This concern has been trying for four years to obtain permission to lay its wires. Action on the report was postponed by the aldermen until Aug. 7.

Not to be Executed by Electricity.—Governor Hill has commuted to life imprisonment the sentence of the murderer Joseph Chapleau, who was to have been executed by electricity some time this week. The electrical apparatus which was to have been used in the execution had been sent from Auburn to Clinton prison, but has been reshipped to Auburn.

The Jersey City Electric Light Company has just closed a contract with the Pennsylvania Railroad Company for 45 arc lights and 400 incandescents for the new roundhouse and Pullman car buildings at Jersey City Heights. This company is also furnishing power to new generators for the street car system of the Jersey City and Bergen Railroad Company.

At the Western Union Telegraph building fire the morning of Friday, July 18, Mr. Harry Madden offered the entire stock of the Empire City Electric Company to Mr. Cockey, the purchasing agent for the Western Union Company, to use at his command. Mr. Cockey kindly thanked him and said this was the first offer of the kind that he had received. The building was completely gutted of its electrical equipment. Thousands of dollars' worth of stock will be required to replace it.

Electrical Company Incorporated in Camden.—Articles of incorporation were filed on the 11th inst. in the Camden County (N. J.) Clerk's office by the Star Electric Company. The objects of the corporation are to contract for and maintain manufactories for machinery and other apparatus for the use or application of electricity. The capital stock of the company is $5,000, and is said to be fully paid in. The incorporators are Norman Marshall, Boston, Mass.; John S. Spruance, Camden, N. J., and Harry W. Simpson, of New York City.

Accident Statistics.—President Andrews, of the Steam Heating Company, of this city, has obtained some very interesting figures from the public records of vital statistics for the city of New York for 1888 and 1889. These records show that in 1888 there were 64 persons killed by the horse cars, 55 by wagons, 23 by illuminating gas, and five by the electric current. In 1889 there were 89 killed by railroads inside the city limits, including horse cars, 57 by vehicles in the streets, 33 by illuminating gas, and eight by electric wires. The total number of deaths from injuries in 1889 was 1,496.

Bids for Electric Lighting.—The gas commissioners met on Monday of last week and opened bids for furnishing light to New York's 890 electric lamps. The United States Electric Lighting Company sent in bids for 236 lamps at 35 cents a night up to Jan. 1, and 43 cents from that date to April 23, 1891; the Brush Electric Illuminating Company, 169 lamps at 35 cents to Jan. 1, and 43½ cents after that, and 69 lamps at 45 cents; East River Company, 189 lamps at 35 cents to Jan. 1, and 45 cents thereafter; Harlem Electric Lighting Company, 104 lamps at 35 cents to Jan. 1, and 45 cents thereafter; Mount Morris Company, 35 cents to Jan. 1, and 45 cents after that.

Mr. H. C. Adams, 115 Broadway, New York, agent of the Ft Wayne Electric Company, has just received an order for ten 60-light Wood arc light dynamos and lamps for the Municipal Electric Light and Power Company, of St. Louis, Mo. This will make 50 Wood arc machines of 60 lights each for this company. Mr. Adams has also received an order for two 60-light machines for the Detroit Electric Light Company, making eighteen 60-light machines and one 40-light for that station At the works of the Ft. Wayne company in Brooklyn one 60 light arc Wood dynamo with its full equipment of lamps is made up every day, besides the large number of smaller sizes. The company's shops have not yet been transferred to Ft. Wayne.

W. T. H.

NEW ENGLAND NOTES.

Branch Office of The Electrical World,
No. 146 Franklin, corner Congress St.,
Boston, July 19, 1890.

The Nantucket (Mass.) Electric Light Company is stringing nine miles of new wire.

Mr. Davies Murdock, representing the Baxter Electric Motor Company, of Baltimore, was in Boston this week.

A new Robinson radial electric open car has been put on by the West End Railroad, Boston, Mass, running from Bowdoin Square to Arlington. It will seat 60 people.

The European Electric Welding Company, according to a cable dispatch from London, was to be paid £60,000 and perhaps more on Wednesday of this week by the English syndicate.

The Lynn (Mass.) Gas and Electric Company has made a new contract for five years with the town of Swampscott, and is already wiring for 65 new arcs in addition to those already in.

The Boston Theatre is to be lighted by electricity. The great gas chandelier that was suspended in the centre of the auditorium has been taken down. The electric lights will be ready before next season.

Dividend.—The New Bedford (Mass.) Gas Light Company, which, as noticed in our last issue, has consolidated with the Edison Electric Illuminating Company of New Bedford, has declared a quarterly dividend of $2 per share.

Lowell, Mass.—The construction of the police telegraph and the rebuilding of other electric lines employs a large number of workmen in the raising of poles and the stringing and readjusting of wires throughout the principal streets of the city.

Concord, N. H.—The trolley wires for the new electric street railway are nearly all in position and there are only a few more poles to be set. Work at the power station is progressing rapidly, the engine being in position and the generator is to be delivered next week, as will be also the trucks for the cars. It is still impossible to tell what will be the date of opening the road, but there is little doubt that some time in August will see it completed.

The Electric Mutual Insurance Company.—Mr. Chas. F. Pallard has been elected secretary and treasurer, vice Herbert H. Fairbanks, who resigned on account of other urgent business interests. The meeting of the members of the company, announced for July 15, was postponed till Aug. 5, as a quorum did not assemble. The company is delighted with the report of the committee appointed by the New England Insurance Exchange to examine into its relations with certain stock companies.

The Thomson-Houston Company is about to erect a new oil-house and japanning room in the rear of its factories A and B at Lynn, Mass. It will be of brick, two stories in height, 60×80 feet, with tar and granite roof. The oil-room, which will be large enough to hold 80 barrels of oil and naptha, will be separated from the rest of the buildings by a fire-wall, iron girders and brick floors. In the adjoining room, over a 20,000-gallon cistern, will be a fire pump and hose carriage. The upper floor will be used as a japanning room.

Worcester, Mass.—The report that the Washburn and Moen Manufacturing Company was to erect a factory at South Chicago is confirmed at the company's headquarters in this city. Charles G. Washburn states that the increased business of the company in the West has led to the movement, and a factory for the manufacture of coarse wires will be erected immediately. The company will make a great saving in freight, which is now a large item, in supplying the Western trade. It is understood that the Washburn and Moen Company would increase its plant largely in Worcester if they could obtain the land that they wish for, adjoining one of its present plants. This particular piece of property is owned by the city, and all efforts to purchase it by the company have been unavailing.

The first annual meeting of the Massachusetts Electric Lighting Association, which was organized in 1889, was held Wednesday afternoon, July 16, at the Hotel Pines, Point of Pines, a summer resort a few miles from Boston. This association includes 30 of the leading local electric lighting companies in the State, representing a capital of $5,000,000. The following is a list of those present, with the company represented by each: Wm. G. Peck, Chelsea Gas Company; F. H. Raymond, Cambridge Electric Light Company; Chas. A. Nichols, United Electric Light Company, Springfield; H. G. Balkam, Edison Electric Light Company, Brockton; C. C. Fry, Lynn Gas and Electric Company, Lynn; F. A. Gilbert, President of the Association, Boston Electric Light Company; R. W. Cutler, Boston Electric Light Company; H. M. Batchelder, Salem Electric Light Company; Everett W. Burdett, General Attorney of Association, Boston; A. W. Rogers, Beverly Gas Light Company, Beverly; H. H. Fairbanks, Treasurer, Worcester Electric Light Company; Geo. B. Neal, Charlestown Gas Company; C. L. Edgar, Edison Illuminating Company, Boston; W. W. Gooch, Counsel Edison Company, Boston; F. Edward Smith, Woburn Electric Light Company; A. S. Temple, general manager Salem Electric Light Company; Theo. C. Bates, Worcester Electric Light Company; F. H. Raymond, Cambridge Electric Light Company; A. Brown and Josiah Pickett, Worcester Electric Light Company; C. D. Morse, president Millbury Electric Company; Owen Durfee, Fall River Electric Light Company; E. H. Blodgett, president Leominster Electric Light and Power Company; T. M. Rogers, Worcester Electric Light Company; Elisha Morgan United Electric Light Company, Springfield; E. L. Norris, treasurer and manager, Gloucester Electric Company; E. F. Blodgett and F. S. Coolidge, Leominster Electric Light and Power Company; Mr. Coggshall, Fitchburg Gas Company; Jos. G. Russell, Chelsea Gas Light Company; C. R. Kimball, Lowell Electric Light Company; F. E. Barker, Board of Gas and Electric Light Commissioners; Dustin Killicut, Boston, and the representative of The Electrical World. The treasurer's and attorney's reports were read and the following officers elected for the ensuing year: President, F. A. Gilbert, of the Boston Electric Light Company; First Vice-President, Hon. Theo. C. Bates, of the Worcester Electric Light Company; Second Vice-President, George W. Fifield, of the Lowell Electric Light Corporation; Executive Committe: Fred A. Gilbert, Hon. Theo. C. Bates, George W. Fifield, C. L. Edgar, of the Edison Illuminating Company, Boston, and C. A. Nichols, of the United Electric Light Company, Springfield. After passing a vote of thanks to President F. A. Gilbert, for his able and efficient management of the affairs of the association, and requesting the Board to prepare a statement of the work of the association to induce the other companies, not members, to join, the meeting adjourned to the dining hall, where a substantial repast was enjoyed.

L. H. H.

PHILADELPHIA NOTES.

Branch Office of the Electrical World,
31 City Trust Building, Philadelphia, July 19, 1890.

Mayor Fitler has signed the ordinance to permit the Suburban Electric Company to erect poles and conduits in the Twenty-third Ward.

Peale, Penn.—The Clearfield Bituminous Coal Corporation has just been equipped with Gould pumps, run by Wenstrom motors, furnished by the United Electric Equipment Company, of Philadelphia.

New Electric Light Plant.—The South Chester Electric Light Company has been incorporated to furnish electric light for the village, and has its plant nearly completed. It is to commence with 500 incandescent and 25 arc lights, and has adopted the La Roche system of lighting.

Two Philadelphia theatres are to be lighted by electricity. One of these is the Kensington Theatre on Trenton avenue, which will be lighted up with electricity when it opens in the fall and the other is to be built this summer at the northeast corner of Frankford avenue and Adams street at a cost of $90,000.

The Kensington Engine Works, contracting engineers, have in charge the steam and electrical plant, including four hydraulic passenger elevators, for the large new stores of Cooper & Conard, Ninth and Market streets, Philadelphia, and expect to have the plant completed in September. The contract covers the Thomson-Houston system of arc lights and will cost $40,000.

Electrically illuminated clock hands are to be used on the face of the tower clock of the new Penn Mutual Life Insurance Company's building on Chestnut street, Philadelphia. The hands are to be made of glass on an iron frame and will be illuminated by incandescent lights so as to have the appearance of immense rods of light. The electric current is to be carried to the lamps by small brushes resting lightly on the shafts which carry the arms. The figures are to be cut through the face of the clock and at night will be illuminated by lights placed at the back of the dial. Two hundred incandescent lamps will be used to furnish the light. The electric plant for the building is now being installed under the supervision of Mr. George H. Almon, of the Thomson-Houston Electric Company. About 2,500 lights will be used in the building.

Philadelphia's Electric Lights.—As to electric lighting of Philadelphia, the annual report of Chief Walker of the city's electrical bureau says: "The service at the close of the year 1888 for street lighting consisted of 756 lamps; at the close of the year 1889 there were 1045 lights. There were also 50 lights maintained at the expense of the Girard Estate on Front street and Delaware avenue, making a total of 1095 arc lights. The introduction of electric lights did away with 496 gas lamps and 42 gasoline lamps. The receipts were $18,655. At the close of last year there were 10,012 poles in use, an increase of 288. At the close of the year there had been 89,244 miles of telegraph, telephone and electric light wires placed underground, and 395,125 feet of wooden conduit, of which the city owns 39,232 feet. The bureau has 903¾ miles of wire overhead and 63.24 miles underground, 240 sentry booths, 257 signal boxes and 5,117 poles, and as the total number of poles is 10,612, the city appears as the owner of nearly one-half of those still in use. There are 4,306 miles of telegraph and telephone wire, and 381 miles of electric light wire.

Electric Railway Construction.—The Equitable Electric Railway Construction Company of Philadelphia is installing the entire plant for the Richmond and Southside Electric Railway, at Richmond, Va. The road is double track, about five miles long, running from the Locomotive Works in Richmond over Seventh street, and across the new bridge into Manchester and Woodland Heights. The overhead work is of the most substantial character. Octagonal yellow pine poles, 18 inches diameter, are used, and each pole has iron steps on its side for convenience in climbing. The Sprague overhead system is being used. There will be five vestibuled Brill cars, each having two 15 h. p. Sprague motors. Patent wooden tooth gearing, built by the Equitable Electric Railway Construction Company, will be used on the cars. The power house is being equipped with one 80,000 watt Edison compound generator, driven by a Ball high speed engine of 100 h. p. The entire equipment of this road, exclusive of the track, including power station, cars, engines, boilers, etc., was awarded to the Equitable Company, and it is pushing forward the work in the most substantial manner.

W. F. H.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
465 The Rookery, Chicago, July 19, 1890.

An electric railroad is promised along 115th street and also along 95th street, Chicago.

Mr. S. Rosenstamm, the general representative of the Lewishon Brothers, of Fulton street, New York, has been a welcome visitor in Chicago this week.

The Milwaukee Light and Power Company has filed its bonds to the city with Phil. Alpeter, Oscar Alpeter, Chris Anstedt and Fred Heyden as securities.

The Western Power Construction Company, The Rookery, Chicago, have taken orders during the past two weeks aggregating 1,000 h. p. in engines.

Mr. Henry Widmer, of the electrical supply house of Matthews, Widmer & Co., 78 Custom House street, New Orleans, La., was a visitor in Chicago the past week.

Mr. S. S. Leonard, manager of the Western department of the Hill Clutch Works, has returned to Chicago after an extended absence in the Southwest in the interest of his company.

Mr. George A. Mayo, general manager and electrician of the Rockford Electric Manufacturing Company, Rockford, Ill., found time to drop in and see his friends in Chicago this week.

The National Electric Ice Company has been incorporated at Chicago to manufacture and sell ice and ice machines; capital stock, $1,000,000; incorporators, Frank K. Biggs, William M. McEwen and Grove E. Walter.

The Universal Electric Construction Company has been incorporated at Chicago for the manufacture and sale of electrical machinery; capital stock, $500,000; incorporators, Charles M. Peale, Edwin Brainard and Frederick H. Wood.

Mr. Charles H. Wilson, superintendent of the Chicago Telephone Company, is the happy recipient of one of the golden treasures, the advent of which in any family clearly answers in the negative Mona Caird's question, "Is Marriage a Failure?"

New Storage Battery.—Mr. T. S. E. Dixon, of Chicago, has patented an improvement in storage battery construction, in which is secured the combination of two electrodes provided respectively, with peroxide of lead and spongy lead, with a third e'ectrode of zinc.

Two suits at law have been instituted by the Western Electric Company in the United States Circuit Court at Chicago against W. C. Clark and Oliver M. Powers, respectively, for an alleged infringement of United States patent 172,983 for an improvement in electric annunciators.

The Mississippi Valley Development Company has been incorporated at East Cape Girardeau, Mo., for the purpose of operating water-works and electric light plants, and the construction and operation of tramways, horse power and dummy roads; the capital stock is $50,000, and the incorporators are George H. Crumb, Lawson H. Watts and Dennis W. Wilson.

Mr. William E. Shaffer, Milwaukee, Wis., has begun a suit in the circuit court for the recovery of $46,750 from A. M. Bailey, George P. Knowles, Jr., B. Stern, M. H. Brand and S. H. Seamans for losses claimed to be due to an alleged attempt on the part of the defendants to depreciate the value of the plaintiff's holdings of stock in the Automa tic Fire Service Company.

Telephone Quotations.—Col. S. G. Lynch, broker, 153 Monroe street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$298@$300	Cumberland	$ 59@ $60
Central Union	69@ 70	Wisconsin	116@ 117
Michigan	98@ 99	Bell of Missouri	140@ 145
Great Southern	30@ 32	Iowa Union	21@ 23
Colorado	38@ 40	Missouri and Kansas	54@ 55
Rocky Mountain Bell	40@ 45		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$104@$105	Chicago Edison Co	$115@$130

Mr. George B. Shaw Honored.—A Milwaukee (Wis.) telegram of the 10th inst. says: "Wisconsin was honored to-day by the Knights of Pythias in the unanimous election of George B. Shaw as Supreme Chancellor, the head of the order in the world." Mr. Shaw, who is known to the electrical fraternity as the general manager of the National Electric Manufacturing Company, of Eau Claire, Wis., has the distinction of being the youngest man ever elected to that office. He is only 36 years of age, having been born March 12, 1854, and he is looked upon as the representative of the young men of the order. He is a native of Allegheny County, New York, but has been a resident of Wisconsin since boyhood. Mr. Shaw is a stanch Republican, and for his work for that party has been rewarded by his election as Mayor of Eau Claire, Wis., and is now being urged by his friends as a prospective candidate for Congress."

F. DE L.

SOUTHERN NOTES.

NORFOLK, VA., July 19, 1890.

Waynesville, N. C.—Another factory for the manufacture of insulator pins is to be erected.

Dawson, Ga.—The City Council is negotiating for the establishment of a system of electric lights.

Buena Vista, Va.—Workmen have recently been engaged in putting in a commercial system of electric lights.

Buena Vista, Va.—A street railway company is organizing, and it is thought that electric motive power will be selected.

Athens, Ga.—It is claimed by the local press that the town will soon have the best arranged telephone system in the State of Georgia.

Portsmouth, Va.—The lights of the new electric light company are now shining brightly, and the new plant is operating very satisfactorily.

Newport, Ky.—The Electric Protector and Specialty Company has been incorporated by H. P. Young and H. G. Rich to manufacture protectors for electrical instruments. The capital stock is $10,000.

Electrical Securities.—Fisher and Shaw, bankers, Baltimore, Md., offer for sale the Decatur (Ala.) Light and Power Company, first mortgage 19 year six per cent. bonds; the Anniston (Ala.) Gas and Light Company consolidated mortgage 25-year six per cent. bonds; the Chattanooga (Tenn.) Electric Railway Company first mortgage 19 year six per cent. bonds; and the Brush Electric Company Baltimore (Md.), first mortgage 20 year five per cent. bonds.

Work was begun on the newly organized Boone and Blowing Rock Telegraph Company's line, recently reported in THE ELECTRICAL WORLD. Blowing Rock has become a very popular pleasure resort in Western North Carolina, and its connection with the outside world by telegraph is an important step.

A Prediction.—The Richmond, Va., *Dispatch*, commenting on a recent paragraph from the *News and Courier*, of Charleston, S. C., says that "before many years all railroad lines will be electric lines." The Charleston item read thus: "The emancipation of the great American street-car horse is near at hand, and it will not be many years before the street railways in all the larger and more important cities will be operated entirely by electricity."

Winston, N. C.—The Sprague electric plant and street railway system has been completed at Winston and Salem, N. C., and on the 14th inst. the electric cars were started amid the playing of bands and the cheers of an assembled multitude. It is claimed that the plant and railway system is not surpassed in the entire country. Mr. F. J. Sprague and other prominent New Yorkers were present. This is the first electric street railway to get into actual operation in the State of North Carolina.

Fanning the Court.—Two electric fans were during the past week placed in the Hustings Courtroom at Richmond, Va., worked beautifully, and lowered the temperature about twenty degrees. These fans were placed in position by local agents for ten days' trial, without charge. If, at the expiration of that time, they prove satisfactory, as they undoubtedly bid fair to do, the officers of the court will endeavor to get the Committee on Grounds and Public Buildings of the city to purchase them, the officers agreeing to pay the cost of the power required to operate them. The electric fans have attained a tremendous popularity through the South this season, and their possibilities become greater and greater the more they are used. The Chesapeake & Ohio Railroad has recently adopted them, and it will not be long before other progressive Southern railways will likewise place them in operation on their cars. That they would be an admirable addition to churches is now generally accepted, doing away with much of that unnecessary and annoying flutter of countless fans. Your correspondent expects, within the near future, to see many Southern churches ventilated by electric fans.

Atlanta, Ga.—The regular monthly meeting of the newly organized Electric Club was held a few evenings ago at their handsomely furnished apartments, No. 41½ Peachtree street. The club is now in a most flourishing condition, and a brilliant success is assured for the future. The members are all men electrically and scientifically inclined, and many interesting arrangements are to be placed in the rooms in the next few days. The present membership numbers fifty, and several prominent gentlemen of Atlanta are expected to hand in their applications by the last of the month. Among the many liberal donations the club has received in the past few weeks is a highly polished maple piano, from the Atlanta Piano Company; from the Atlanta Electric Light Company, a full supply of incandescent lamps; the Southern Bell Telephone Exchange, a telephone; the Phonograph Graphophone Company, a phonograph, and the Postal and Western Union Telegraph Companies put in connection with their respective offices. Such generous donations as the above will make the Atlanta Electric Club the largest and most enjoyable of any of its kind in the South. The charter members are men of decided electrical ability and reputation, and no pains or expense will be spared to have the latest electrical appliances at the club's handsome quarters. Such an organization is most beneficial and instructive as well as a centre point where all those interested in electrical inventions and appliances may meet in pleasant social intercourse. The success which has thus early attended the formation of the club in Atlanta will be stimulatingly instrumental in bringing about the organization of electric clubs in other Sothern cities, notably Richmond, Nashville and Birmingham. The first of these cities is now well prepared to sustain a flourishing body, and if so energetic and congenial a spirit as Dr. Leigh Burton, the well-known electrical inventor, will take the matter in hand, there will be little difficulty in organizing a club that will equal that just formed in Atlanta, in point of membership and importance.

Y. N. B.

ENGLISH NOTES.

(*From our own correspondent.*)

LONDON, July 12, 1890.

The Telephone Companies and the Electric Light Companies.—The crop of litigation which is promised upon your side of the water between telephone and electric traction companies, has been avoided between telephone and electric light companies in this country by the decision of a select committee of the House of Commons. The National Telephone Company opposed the Provisional Orders promoted by the Corporation of Birkenhead in order to obtain the insertion of a clause obliging the "undertakers" to construct their works so as to avoid disturbance not only of *existing* telephone circuits, but of any that might in future be erected. After a lengthy argument the select committee drew up a clause having the effect desired by the telephone company. As it was announced that whatever clause the committee adopted would be inserted in all electric lighting orders by the Board of Trade, we may consider the question of who is to protect telephone circuits as settled.

New Electrical Companies.—The 1st of July being the last day upon which notices of intention to apply for electric lighting Provisional Orders may be served upon the local authorities interested there has been during the last few weeks a mild repetition of what happened last year. A large number of notices have been served upon local authorities and a corresponding number of local electric light companies have been hastily registered to take up these Orders in the event of their being obtained. Last year the notices were far more numerous, and the total capital of the companies was something very formidable. On the present occasion, however, the companies have in most cases been registered with nominal capitals, such as £1,000 or £100, their promotors having apparently learned by past experience that the chances of a private company obtaining statutory powers are, as a rule, so small that it is not worth while to pay the heavy fee demanded where large capitals are registered until the powers sought are actually granted.

Gas Strikes and the Electric Light.—Owing to a strike of the gas stokers, the Leeds municipal gas works were last week unable to meet the demands made upon them, with the result that Leeds was left in darkness, and but for the presence of two cavalry regiments and large bodies of police the town would doubtless have also witnessed scenes of wild disorder. Indoors wax candles and oil lamps in some degree suplied the place of the gas burners, but in a few instances the aid of electricity was called in. At the offices of the Yorkshire *Post* there was a remarkably smart performance by a local electrical engineer. At 11 A. M. he received an order to install 150 lights in time for that evening's issue. Operations were commenced at 2 P. M. and by 11 P. M. the whole of the premises were brilliantly illuminated, everything but engines and boilers having been got ready within 12 hours of the receipt of the order. Had the strike lasted longer I should probably have been able to chronicle a similar display of enterprise in regard to the lighting of the main streets of the town.

Bath.—The electric lighting of the principal streets of Bath, which was inaugurated some three weeks ago with considerable éclat, has already given the local press occasion for vigorous writing. The heavy rains of the past ten days have, it appears, found out several weak places in the arc light circuits with the result that a large number of the street lamps have either gone out after a few hours or have not lighted up at all. Matters will, doubtless, soon be in proper order, though the language indulged in by the Bath papers would lead one to suppose that scarcely a lamp was ever alight, and that the faults which have unfortunately developed themselves were inherent to electric lighting. The ultimate capacity of the Bath central station will be 300 arcs and 30,000 incandescents, the plant consisting of two 75-kilowatt Mordey alternators and four 50-light Thomson-Houston arc light machines. The mains are entirely underground, 30 miles of cables being already laid. The system employed is Callender's solid system, which consists in laying the cables in iron troughs which are then filled with liquid bitumen, the whole being covered in with a cast iron lid. The cables are arranged in layers one above the other, and are supported at intervals by wooden bridge pieces.

The Telephone Companies and the Government.—Owing probably to the fact that public attention has been occupied lately with the disturbed political situation and the serious strikes impending or in progress, the recent announcement that the government does not propose to purchase the telephone system of the country has, until within the last day or two, been allowed to pass without comment. On Monday last, however the Duke of Marlborough, who seems to have taken this particular question under his special patronage, called attention in the House of Lords to the statement of the Postmaster-General with reference to the purchase or rather non-purchase of the telephones; and asked whether considering the national importance of the decision arrived at by the government, the bold statement of the Postmaster-General could not be supplemented by a few reasons, the answer received by the Duke of Marlborough was of that enigmatic description characteristic of "official" replies: "The Postmaster General had said that the government did not intend to give notice to purchase the undertakings of the telephone companies at the end of the year, but that did not debar the post office from undertaking telephonic work. The Government did not intend to adopt the policy of purchase by the State of the telephone companies. To do so would be to involve the State in a gigantic enterprise into which the Government was not prepared to enter. The Government intended to grant licenses to new companies which might apply for them. When the chief telephone patents expired competition would most likely arise, and in that way the public would reap with the least risk the benefits which the noble duke anticipated." From this we may certainly gather that all question of State purchase is at an end until the next opportunity arises in 1897, and it would seem as if the future policy of the post office in regard to the telephones is to continue to be one of semi-hostility. Confusion is to be engendered by granting licenses to competing companies, and we are promised the undignified spectacle of a Government department entering into sharp competition with its own licensees. How the public will benefit by this mode of procedure is not apparent on the surface. The rates at present charged by the National Company are undoubtedly high, and the service, especially in the metropolis, is not all that could be desired. On the other hand, I have good reason to believe that we shall shortly see a general reduction of rates, and as to the defects of the London system they are rapidly being remedied. The National Company, moreover, it is generally admitted, has shown itself to be animated by public spirit as well as by a spirit of dividend earning, and this is evidenced by its enterprise in covering the country with trunk wires, many of which are likely to remain unremunerative for several years. It would, therefore, seem as if the proper policy of the post office, now that it cannot work the telephones itself, is to lend assistance to the National Company in its efforts to give the public the full benefit of the telephone.

News of the Week.

THE TELEGRAPH.

The Telegraph Printing Company has obtained the right to erect poles in Providence and Lincoln, R. I.

English Telegraphers Win.—A London telegram of July 15 says that an increase of pay and other concessions have been granted by the government to the telegraphers.

Every telegraph wire on the Union Pacific Railway near Sidney, Neb., is reported to have been cut recently by bullets from the revolvers of a lot of cowboys. All the glass insulators in the vicinity were also broken by the same means. Communication was interrupted for nearly a day.

From Bismarck to Galveston.—The charter of the Dakota, Wichita & Galveston Railroad Company gives the right to build and operate a telegraph line in connection with a standard gauge railroad from Bismarck, North Dak., to Galveston, Tex. No contracts have yet been let. The directors are C. Eisenmayer, Jr., and others, of Halstead, Kan.

Postal Telegraphs.—The next issue of *Frank Leslie's* will contain an article on the postal telegraph from the pen of Mr. Francis B. Thurber, the well-known New York merchant, who will present the argument in favor of the proposal to establish cheap and uniform telegraph rates between the carrier delivery offices of the country, and to contract for the conveyance of messages with existing telegraph companies, or others which may be established. Mr. Thurber's article will be followed by one from Mr. Erastus Wiman, who, as a director of the Western Union Company, may be expected to present the argument in opposition to the projects from the standpoint of the telegraph corporations of the country.

A New Pacific Cable.—A San Francisco (Cal.) correspondent of the New York *Tribune* says: "Last year John T. Waterhouse, of Honolulu, went to New York and Europe to obtain capital for laying an ocean cable from San Francisco to the Sandwich Islands. He found no encouragement in New York, because of the unsettled political condition of Hawaii and the uncertainty of tariff legislation. In England, however, he found capital more eager to embark in South Sea schemes, and he is sanguine that an English syndicate will soon be formed to lay a cable from this city to Honolulu and then extend it to Auckland and Sydney. Mr. Waterhouse thinks that the large sums English syndicates are putting into Australia and many South Sea islands make an ocean cable to this country necessary."

THE TELEPHONE.

The Cumberland Telephone Company, Nashville, Tenn has declared a quarterly dividend of one and a quarter per cent.

Struck by Lightning.—The tower of the Telephone Exchang at Wheeling, W. Va., was recently set on fire by a flash of lightning and badly damaged. All telephone communication was interrupted for several days.

The Middletown (N. Y.) Exchange of the Hudson River Telephone Company now has 66 local subscribers, and connections with several distant points by trunk line circuits. Mr. Fred T. Case is the manager. This exchange has a branch office at Goshen, N. Y.

THE ELECTRIC LIGHT.

Plaquemine, La.—It is reported that an electric light plant is to be erected in connection with the water works.

Maryville, Tenn.—The erection of an electric light plant is contemplated.

Alexandria, La.—It is reported that an electric light company will be organized in a few days.

A small dynamo, of 12 to 16 incandescent light capacity, is wanted by W. M. Graham & Co., Cartersville, Ga. Prices are desired.

Middlebury, Vt.—The water wheel which is to furnish power for the electric light plant has arrived. The contract called for the operation of the lights by the 15th inst.

Tecumseh, Mich.—The new electric light plant was started on the 9th inst. for the first time. The lights, which are of the Thomson-Houston system, are 1,200 c. p. arcs, and give general satisfaction.

Coaticook, Can., has decided to adopt electric lights for its streets. Mr. A. J. Corriveau has obtained the contract and will install a plant of 30 arc lights and 500 incandescents. Water power will be used.

Plainfield, N. J.—John Chandler has brought suit against the Plainfield Electric Light Company to recover $3,000 damages for a horse which was killed by electricity through the breaking down of one of the defendant's wires.

The Anglo-American Electric Light Company's factory at Kensington, Conn., was burned July 16, causing a loss of about $35,000, with an insurance of about $15,000. The three buildings of the company were entirely destroyed.

Again in Operation.—The electric lights have again been put in service in Stoneham, Mass., after over a month of darkness owing to a disagreement on the renewal of the contract between the selectmen and the Woburn Electric Light Company.

Dayton, O.—The Central Thomson-Houston Company has taken the contract to replace the present system of arc lights with 250 of the latest Thomson-Houston pattern. Five 50-light dynamos will be used and driven by water power. A large Buckeye engine is kept as a reserve in case of failure of the water power.

San Francisco, Cal.—The Brush Electric Company and the California Electric Light Company have instituted a suit in the circuit court against the Electric Independent Company for an alleged infringement of patent rights owned by them for arc lamps and other electrical apparatus. An injunction and an assessment of damages are demanded.

Woodsville, N. H.—The committee that has for several weeks been looking over the various systems of electric lighting has decided on the Brush electric light and work will be instituted at once. The contract for a one-story brick building 38 × 40 feet, a 100-h. p. engine, 125-h. p. boiler, the foundation for the dynamo, and all the machinery except the dynamo itself has been awarded.

A New Plant Started.—The Jenkintown (Pa.) Electric Light Company inaugurated its new system of lighting by incandescent lamps on the 12th inst. The plant is located near Jenkintown Station, and from that point it is proposed to furnish light to adjacent districts, including Ogontz, Chelten Hills, Glenside, Moortown, and other places. The capital of the company is $50,000.

A bill for injunction was filed in the superior court against the erection of the proposed electric light plant of the Chicago Edison Company at 2638-40-42 Wabash avenue. The plaintiffs are people who own houses in the locality. The injunction has not yet been issued, but the property owners say they will press the matter as soon as the company's work shows that there is any immediate danger.

An ordinance has been filed at Cincinnati, O., by the Jones Brothers Company to authorize them to operate under the general electric light and power ordinance of the city. The Court of Common Pleas has decided that the Jones Company is only a manufacturing concern and as such is not authorized to continue the business of electric lighting. The decision, however, has been appealed and is now pending in the Superior Court.

A handsome arc lamp has been designed at the Thomson-Houston Electric Company's works at Lynn, Mass. The lamp has the standard Thomson-Houston style of mechanism, but the frame and fixtures are different. It has a very handsome iron frame designed to go on an iron post, and beneath the lamp in a fine piece of scroll work, is the monogram "T.-H." This lamp it is said is designed very largely for the European market.

The Monongahela Electric Light Company, with a capital stock of $40,000, has been chartered at Monongahela City, Pa. The officers of the company are: Edward G. Acheson, president and general manager; S. A. Duncan, vice-president; J. W Marsh, treasurer, and S. H. Houston, secretary. A city ordinance was granted to the company on the 14th inst. The alternating current system will be used, the plant at first having a capacity of 650 lights.

At Nanaimo, B. C., on June 30, a 500-light incandescent plant of the Ball type, and manufactured by the Ball Electric Light Company, of Toronto, was set in motion by the company's Western representative, Mr. R. B. McMicking. The occasion marked the introduction of the electric lighting industry into that "Black Diamond" City, the Newcastle of the British Pacific. All the arrangements were perfect; the machinery worked with satisfactory smoothness, and the new illuminant was at once an object of admiration to the great numbers visiting the station. It is understood that additions to the plant will be made almost immediately.

A branch office for the Central States district has recently been opened at Cleveland, O., by the United Edison Manufacturing Company with Mr. S. D. Nesmith in charge, to attend to the business of Northern Ohio and Indiana. Some of the recent installations made by Mr. Nesmith are, 200 lights for the Conant Bros. Furniture Company, Toledo, O.; 1,000 lights for the Oliver Chilled Plow Works, South Bend, Ind.; a 200 light plant for the Standard Oil Company, Cleveland, O.; 200 lights for the Hodgman Manufacturing Company of Sandusky, O.; a 400 light central station plant for Berea, O., on the circuits of which four low tension arc lamps are running very successfully; and a 2,500 light Edison plant in the Hotel Hollenden, in Cleveland, O. The success with the low tension arc lamps is said to be very complimentary to the system, as they give a steady and brilliant light.

APPLICATIONS OF POWER.

Sedalia, Mo.—An electric car line was inaugurated early in the month.

Knoxville, Tenn.—The Cherokee Land Company expects to build an electric railway to its property.

Beaufort, S. C.—A route has been surveyed, it is said, for an electric railway from Beaufort to Port Royal.

Berkeley, Cal.—The track of the Oakland & Berkeley Rapid Transit Company's electric road is nearly laid to Temescal.

Another dynamo and engine have been purchased for an increase in the electric street railway plant at Chattanooga, Tenn.

Boston, Mass.—Electric cars have been placed on the Pearl street line of the Cambridge division of the West End Street Railway.

The St. Elmo extension of the electric street railroad, at Chattanooga, Tenn., was opened for regular service early in the month.

To Connect Four Towns.—An electric railway is projected between Attleboro, Mass., and Pawtucket, R. I., via Dodgeville and Hebronville.

Pueblo, Colo.—The electric road from Pueblo to the lake has been put in operation. Two trains of two cars each run at intervals of five minutes.

Tesla motor fans are now being used on the library car of the "Chicago limited," running through Pittsburg, Pa. A fan is placed in each end of the car.

Atlantic City, N. J.—It is reported that an electric railroad is to be constructed on Pacific avenue. Some opposition is manifested by property holders along the route.

Newton, Mass.—The aldermen have passed an order requesting the Newton Street Railway Company to place guard wires above the trolley wires of its road before operating its cars.

Electric Railway Sold.—The Appleton (Wis.), electric street railway was sold recently to the Appleton Edison Light Company. It will be re-equipped, it is said, with the Sprague system at a cost of $40,000.

Pittsburg, Pa.—The West End Street Railway Company is just about to bid good-bye to its more or less decrepit equines and inaugurate an era of electric locomotion upon its lines. The Thomson-Houston system will be used.

A temporary injunction has been served on the electric railroad company at Augusta, Me., by the New England Telephone Company to prevent the former from interfering with the telephone line between Augusta and Gardiner.

The First Number of the *Electric Railway News* has appeared in Boston, Mass. The paper is published once a week, and has four pages. It is conducted by Mr. W. F. Brewster, the first business manager of *Modern Light*, now *Modern Light and Heat*.

McKeesport, Pa., one of the most progressive and important boroughs in the State, is about to have an electric railway leading from the center of the town to Six Miles Ferry, three or four miles distant. No decision has as yet been made with regard to the system to be used.

Six Edco cars, each equipped with two 10 h. p. motors and 100 cells of the Accumulator Company's storage battery, have been sold to a street railway in the West. Each car is also supplied with 100 extra cells of battery as a reserve to be charged while the other set is in service.

Quincy, Mass.—The Manet street railway constructed from Quincy station to the shore at Hough's Neck, made its first passenger trip on the 16th inst. An open car equipped with a Sprague motor, was used and 65 persons took the trip upon invitation of Superintendent G. W. Morton. Three and three-quarter miles of track are in operation.

The Newark (N. J.) Passenger Railway Company's application for a franchise to run its Orange and Newark line by the overhead system of electrical traction came up before the Orange Common Council on Monday evening of last week, and the request was granted, without the slightest opposition, by a practically unanimous vote.

Danger of Electric Cars.—In reply to the statement of a Cleveland, O., paper regarding the extreme danger of electric cars, the Duluth (Minn.) *News* says: "To cities with limited population that might seem a serious matter, but Duluth can afford to run the risk rather than do without the railways. A progressive citizen would rather be killed outright than suffer the torture of riding after mules all his life."

Pittsfield, Mass.—At a meeting of the directors of the Pittsfield Street Railway Company held July 15 it was voted to sell the road for $17,000. A new company is to be organized, with a capital of $35,000, shareholders in the old company to have the privilege of taking stock in the new in proportion to the old stock held. The new company will be organized immediately and will take steps at once toward equipping the road with electricity.

Holyoke, Mass.—The scheme to organize another street railway at Holyoke, with electricity as the motive power, which was agitated several months ago, has been revived and it is understood that an application has been made to the State authorities for a charter. In case the latter is granted and the new company can secure a franchise from the city government, it is proposed to put $75,000 into the venture and equip the road at once.

An Alternating Current Motor.—The Westinghouse Electric and Manufacturing Company is now making a new alternating current motor which is said to possess many advantages over any similar motor. As it does not require current of any higher pressure than the ordinary 50-volt alternating current, it is especially applicable to the operation of sewing machines and other work requiring only a small amount of power. The company has already received orders for 500 motors.

Braddock, Pa., will surely have an electric railway in the near future. At the present time, there are no less than five separate organizations making efforts to obtain a right of way through the borough. Home capitalists are interested more or less, while Pittsburg men are also taking a hand in the contest. The line will run from Braddock to Brinton, Turtle Creek and Wilmerding, in the Turtle Creek Valley, which, thanks to the energy of the Westinghouse people, is being developed with marvelous rapidity.

Newburyport, Mass.—The Plum Island Street Railway has been transferred to the Black Rocks & Salisbury Beach Street Railway Company. The consideration is $1, and the grantee engages to pay the debts of the grantor, amounting to $40,000, and pay $100 per share for the stock on demand. A mortgage has also been recorded from the Black Rocks & Salisbury Beach Street Railway Company to the International Trust Company for $105,000 to guarantee bonds to be issued to pay the debt of $40,000 of the Plum Island road and the debt of the Black Rocks & Salisbury Beach Railway. The paid up capital stock of the latter road has been increased to $225,000.

Electric Cabs.—It is said that Pittsburg, Pa., is next to have electric cabs. Superintendent J. B. Grimes of the Knoxville Land Improvement Company says that a system of electric cab lines will, in the near future, be placed in operation throughout Knoxville. Beltzhoover and Mt. Oliver. These three suburbs are perched upon a part of the numerous hills that surround the city. The Knoxville Land Improvement Company and the South Side Rural Traction Company contended for rights of way, the latter concern came off victor, and now its opponents intend to transport the public in cabs instead of the regulation street cars. The storage battery will be used in the cabs.

Stockholders' Meeting.—The stockholders of the Citizens Traction Company of Pittsburg, met on the night of July 15, and unanimously adopted the recommendation of the board of directors to increase the capital stock of the company from $2,500,000, to $3,000,000. This increase of $500,000 is to be allotted to the stockholders of record on July 31, 1890, at par and is to be used in extending the rapid transit system of the company to Sharpsburg, a suburb five miles from the heart of the city, and other points. The statement of the company for the first half of the year 1890, shows its receipts to have been $288,000, and its expenses $200,000; leaving a net profit of $88,000, of which sum $75,000 has been applied to dividend paying. The Citizens Company operates the cable system between Pittsburg and East Liberty, and Pittsburg and Lawrenceville. It is probable that in the extension of its system, electricity will be the motive power adopted.

Five Months' Orders.—The printed statement of the Thomson-Houston Electric Company shows that orders have been received in the railway department for the five months from Jan. 1 to June 1, 1890, for 1,505 motors, aggregating a total of 22,520 h. p., and for 194 generators of a total of 17,360 h. p., making in all orders for 39,880 h. p. of electric railway machinery in five months. The company's monthly bulletin for June also contains a list of 77 Thomson-Houston roads now in operation, employing 920 motor cars and an equipment of 556 miles of track. Thirty-six roads are under contract to employ 336 motor cars and to construct 297 miles of track equipment. This last summary includes a contract for a Bremen (Germany) equipment of six motor cars and two miles of track. It is also worthy of note that the government of New South Wales has ordered of the Thomson-Houston International Electric Company a sample equipment consisting of three cars and one 80 h. p. generator.

Appreciation of the Electric Cars.—"There is certainly one thing that all people who have any pity for animals can have reason to feel proud of in Utica, N. Y.," says the *Observer* of that place in a recent issue, "and that is that a great many horses are relieved of very hard work and almost a canal mule's lot by the introduction of electricity on the street cars. These hot and scorching days that we have just passed through would have been particularly hard on the jaded beasts, and all lovers of horses should rejoice greatly that the animals are relieved. There are probably few kinds of work more wearing on a horse than hauling a street car, but it doesn't seem to worry the current of electricity that propels the cars much faster than the horses ever could, and the big engines that create the energy at the power houses pant and puff, not because they are tired, but with eagerness to do properly the bidding of the skillful minds that designed them." Utica has 20 miles of electric railway equipped with 25 motor cars.

New Railway Work.—The first electrical equipment turned out by the Westinghouse Electric and Manufacturing Company was put in operation on the Pleasant Valley road, Pittsburg, Pa., July 4, and has been in successful daily operation ever since. The motor made by the Westinghouse Electric and Manufacturing Company does not require wrought iron pole pieces. Its principal part is a strong and rigid cast iron frame which carries the bearings and pole pieces. The gear wheels and pinions have broad faces; in fact, everything about the apparatus indicates strength and reliability. The caps for the bearings and the pole-pieces are arranged so that the armatures, coils and field magnets can be conveniently removed for the purpose of repairs, and there is used an electric governing apparatus of novel construction. To protect the gears from rapid wear, and to deaden the sound, it is proposed to surround the gear wheels by a cast iron dust-proof box, which will contain a sufficient amount of oil to keep the teeth of the gears constantly lubricated. This lubrication will lessen the friction and the noise, and the box which will surround the gears will so far deaden the sound as to make it unobjectionable.

MISCELLANEOUS NOTE.

The Thirty-ninth Meeting of the American Association for the Advancement of Science, will begin at noon on Tuesday, August 19, at the Denison House, Indianapolis, Ind. The general sessions of the Association, which will begin on Wednesday, the 20th, and continue until the Tuesday evening following, will be held in the State House. Prof. T. C. Mendenhall, the retiring president of the Association, will deliver his address on Wednesday evening, August 20. Saturday, August 23, will be given up to excursions and the meeting will close with excursions extending up to August 30. All matters pertaining to membership, papers and business of the Association, should be addressed to the permanent Secretary F. W. Putnam, Salem, Mass., up to August 15.

PERSONALS.

Mr. Harry C. Wilson, superintendent of the government telegraphs, Jamaica, West Indies, was a caller at our office one day last week.

Mr. E. W. Burdett, attorney for the Boston Electric Light Company and the Massachusetts Electric Lighting Association, sailed for Europe last week.

Mr. M. M. Gillespie, of the Westinghouse Electric and Manufacturing Company, left for London on the 7th inst. to represent the company there permanently.

Mr. John I. Beggs, of this city, will assume the duties of manager of Edison General Electric Company for the Central States district, August 1. His headquarters will be at Chicago.

Mr. W. Dwight Wiman, of the Richmond Light, Heat and Power Company, Staten Island, will have charge of an elaborate electrical exhibit to be made the last of the month on the new Polo Grounds at Livingston station, Staten Island, for the benefit of the local Woman's Exchange.

Mr. Stephen E. Barton, president of the Electric Mutual Insurance Company, of Boston, Mass., was in New York last week on business, and found time for a pleasant call at our office. Mr. Barton reports that he and his colleague, Capt. Wm. Brophy, are meeting with an unexpected success in placing insurance upon electric light stations.

Mr. James W. Queen, of Philadelphia, died at Cresson, Pa., Saturday, the 12th inst. Mr. Queen was born in Philadelphia in 1813, and began his business life there when little more than a boy. In 1848 he established the well-known house of James W. Queen & Co., New York and Philadelphia, which has since earned a wide reputation. Mr. Queen retired from business in 1868.

Major Edward T. Rowell has been appointed to a second term as a member of the Board of Gas and Electric Light Commissioners, of Massachusetts. He is a graduate of Dartmouth Col-

lege, class of 1861. He was first appointed on the commission by Governor Robinson for one of the short terms, and was appointed for a first full term three years ago by Governor Ames.

Mr. A. Stuart, who has charge of the affairs of the Central Thomson-Houston Company, at Cincinnati, has been spending some time in the East, visiting Boston and New York, combining business interests with a pleasant outing for himself and family. Mr. Stuart called at our office last Saturday, and gave us some very interesting information regarding the work of his company in the central West.

Col. C. M. Ransom, whose association with *Modern Light and Heat* for several years has made his face familiar to the electrical fraternity at the semi-annual gatherings of the National Electric Light Association, has announced that he has disposed of his entire interest in that periodical. Col. Ransom's friends will be pleased to learn that he has very largely recovered from his recent severe illness.

Mr. C. G. Armstrong, manager of the house goods department of the Great Western Electric Supply Company, of Chicago, called at our office last Saturday. He was in the East on business for his company, and is making provision for the fall trade, anticipating a splendid business in his line of supplies. Mr. Armstrong has many friends among electrical people in the East, who are always glad to see him.

Mr. Thomas G. Smith, Jr., recently of Cincinnati, O., has been admitted to partnership in the firm Charles R. Vincent & Co., consulting and contracting engineers, New York city. Mr. Smith was formerly identified with the Ball engine business in Cincinnati. He is a member of the American Society of Mechanical Engineers and has been for some time associated in business with the firm which he now joins as a partner.

Mr. C. S. Haley, of the Thomson-Houston Company, made a trip to Pittsburg, Pa., last week. Mr. Haley says his company intends to make a display of no small magnitude at the forthcoming exposition to be held in Pittsburg. It is to be taken for granted that the Westinghouse Company will be in no wise behind its competitor in the way of exhibiting electrical appliances at the fair above mentioned. Electricity, therefore, will doubtless occupy a prominent place in the exhibition.

Industrial and Trade Notes.

R. T. White, of Boston, has received an order from the Essex Passenger Railway, of Newark, N. J., for 80,000 "daisy" chairs.

T. F. Welch & Co., Boston, Mass., are making a specialty of brass screws, nuts and fittings for electrical purposes, and are doing a nice business.

Messrs. Paine & Francis are to furnish two 500 light Edison machines and one 100 h. p. McIntosh & Seymour engine for the new Boston Stock Exchange building.

The Magic Introduction Company, 227 Broadway, New York city, is introducing all kinds of patented specialties, among which is the Thomas acoustic telephone.

The Pettingell-Andrews Company, Boston, Mass., has been appointed general agent for the Massachusetts Electrical Engineering Company's tested fuse wire, and has a large supply of all sizes on hand.

The Electric Gas Lighting Company, of Boston, Mass., shipped a car-load of its specialties to the Great Western Supply Company, Chicago, last week, including 3,000 Samson batteries, automatic bells, etc.

The Knapp Electric Works, 54 and 56 Franklin street, Chicago, have shipped several hundred of their celebrated needle annunciators and burglar alarms during the past week, as well as an abundance of other house goods.

The Illinois Electric Material Company, 339 and 341 The Rookery, Chicago, has secured several handsome orders for bare copper wire for electric railway circuits, and has also furnished a large number of poles for similar plants.

American Belts for Brazil.—Among the recent orders for the celebrated short lap oak belting by the Jewell Belting Company, of Hartford, was one for the entire outfit, including an electrical plant, of a very large woolen mill in Caxias, Brazil.

The Sunbeam Incandescent Lamp Company, Chicago, has found the capacity of its factory far too small to meet the demands for its incandescent lamp, though it has been running night and day, and it is now arranging for additional room.

Edward Harrington, Son & Co., machinery manufacturers of Philadelphia, are running their factory to its full capacity. They have recently made some large shipments to Pueblo, Colo., San Francisco, Cal., and other points in the West.

Mr. G. A. E. Kohler, manager of the Chicago office of the Eddy Electric Manufacturing Company, has just placed a 3 h. p. Eddy motor with R. J. Ederer & Co., Wabash avenue, for driving machinery used in the manufacture of fishing nets and hammocks.

The Wheeler Reflector and Light Company, of Philadelphia, has just moved into its new store No. 22 South Fifteenth street This company contracts for lighting towns and cities, and is doing a brisk business in the manufacture of reflectors for gas, oil, and electric lights.

Isolatine is said to be a very fine composition, in many respects equal to hard rubber. The Roessler & Hasslacher Chemical Company, 73 Pine street, New York city, well known for its chemical engineering skill, is introducing Isolatine to the manufacturing companies of this country.

The Electrical Supply Company, of Chicago, has issued a descriptive circular of the Wirt lightning arrester. This instrument is intended for either arc or incandescent circuits for either direct or alternating currents. It was fully described and illustrated in THE ELECTRICAL WORLD of May 10, 1890.

Mason Reducing Valve.—At some recent tests made with the Armington & Sims engine by the Thomson-Houston Electric Company, the Mason reducing valve received a very flattering indorsement, performing its work in such a satisfactory manner that a special letter of indorsement was sent to the company.

The Gate City Electric Company, of Kansas City, Mo., announces to consumers of electrical supplies that it has just received a large stock of hard rubber in sheet, rod and tube. This is said to be a very superior article, containing no mineral substance. It can be turned easily and takes a beautiful bright finish.

The Electric Mutual Insurance Company, of Boston, Mass., announces that it is prepared to place insurance on all kinds of property in first-class companies. Manufacturing property and electric stations eligible to the Electric Mutual Insurance Company will be placed in that company. All other risks that may be offered will be placed in other companies.

Messrs. E. A. Wildt & Co., 83 Murray street, New York city, has issued a new catalogue of its novelties. Some of its special features are the Yale lock burglar alarm switch, the door bell-pull attachment, various appliances for gas lighting, and a great variety of electric locks. This firm manufactures electric bells, annunciators, door openers, burglar alarms and general electric supplies.

Julius Andrae, 225 West Water street, Milwaukee, Wis., has secured the contracts to wire the $150,000 residence of D. L. Plumer, Wausau, Wis., for incandescent lights, burglar alarms, annunciators, bells, etc.; the Grand Hotel at Sheboygan; the A. G. Schultz Company's paper box manufactory for a 100-light Mather incandescent plant, etc.; and has just finished installing a 100-number annunciator at Draper Hall, Oconomowoc, Wis.

Mr. F. E. Huntress, formerly with the Mitis Wrought Iron Casting Company, has accepted a position with the American Steel Car Wheel Company, and has been placed in charge of the casting and magnet metal department. He will devote his energies to providing a superior metal for the motor and dynamo trade. Mr. Huntress has a large circle of friends who wish him the greatest of success in his new venture and who do not doubt that he will "get there."

The New England Wiring and Construction Co., Boston, Mass., has secured the contract for furnishing the Boston Chamber of Commerce with the wiring and interior conduit necessary for the successful operation of 1,000 incandescent lights. No gas pipes will enter the building. It has also contracted to wire and furnish the conduit necessary for 225 lights in the new Bradley building corner Mason and Tremont streets. Combination fixtures will be used in the building.

Messrs. Hatzel & Buhler, 29 West Twenty-sixth street, have taken the contract to put in 700 lights in Le Boutillier's new dry goods house on Fourteenth street, in this city. The plant will be equipped throughout with the new Van Vleck feeder switches. This firm has also taken a contract to install 125 lights in the United States Bank, in this city. The Detroit motors for which they are agents are giving excellent satisfaction, and are meeting with splendid success.

The Wainwright Manufacturing Company of Massachusetts has recently supplied the following heaters to electric light and power companies: Plymouth Electric Light Company, Plymouth, Mass., 250 h. p.; Schuyler Electric Light Company, Middletown, Conn., 150 h. p.; Stillwater Gas and Electric Light Company, Stillwater, Minn., 150 h. p.; Waltham Gas and Electric Company, Waltham, Mass., 300 h. p.; the Electric Light Department, City of Easton, Pa., 400 h. p.

Messrs. Pierce & Thomas, 42 Cortlandt street, New York, agents for the McIntosh and Seymour automatic compound, tandem compound, and other engines for electric lighting, and engineers and contractors for the installation of electric light and power plants, have just installed a 13 × 19 × 15 tandem compound engine for the Jamaica and Brooklyn Electric Railroad Company. They are also installing one 13 × 19 × 15 tandem compound engine with boilers, etc., for the Columbus Street Railroad, Columbus, O.

The Gethins Primary Battery.—Some recent tests of the Gethins battery seem to have developed the fact that it is a success in the matter of charging storage batteries for running sewing machines, dentists' lathes, etc., and the Gethins company is making a special effort to introduce its battery for use in this class of work. It is said that the consumption of zinc in six of the Gethins batteries which had been in use in Boston for 14 months and 21 days did not equal the amount consumed by one "Crowfoot" battery in six months.

The rapid advance the Baxter Electric Motor Company, of Baltimore, Md., is taking is being appreciated by power users all over the country. The demand for the Baxter motor has so steadily increased that the company has been compelled to double its force of hands and run its machinery day and night. The shipments for the present month to the north, west and south have greatly exceeded those of any month during the company's existence, and it is now two or three weeks behind orders. This steady demand for the Baxter motor is but proof of its high efficiency and the universal satisfaction it is giving.

The Electric Construction and Supply Company, 18 Cortlandt street, New York city, manufacturer of arc lamps for low tension systems, has taken an order to install 40 of these lamps in the Grand Central Depot on the Edison three-wire system. This company is driven to its utmost capacity to fill orders. Nearly 500 of these lamps are in regular service in Brooklyn, and more than that number in New York city. They are being successfully used on every low-tension system in the country, particularly on Edison central station circuits. They burn with a pure white light, steady and uniform. The carbons of these lamps, which are made especially for this company under their own patents, are an especial feature, and the company proposes to maintain its patent rights against all infringers.

The Eureka Tempered Copper Company, of North East, Pa., has received the following letter from Mr. C. R. Huntley, General Manager of the Brush Electric Light Company, Buffalo N. Y.: "Some time about eight months ago we began the use of tempered copper for commutator segments on the Brush machine, and we have had remarkable success with its use. We find that they wear about three times as long as any ordinary segments made of copper. We have tried the experiment of using tempered copper for brushes and beg leave to report the result. The first of March we put a set of brushes on a dynamo, and they were not trimmed until the 17th of April. This is a remarkable showing, and you may count upon us as stanch advocates and constant users of tempered copper in this line of our business."

The American Leather Link Belt Company, of New York city, through its excellent exhibit at the Paris Exposition last year secured the right to manufacture these belts in the states of Austria and Hungary. A complete set of tools has been sent to Poeschle & Sons, Vienna, who are making these belts under the patents of Charles A. Schieren, of New York. Poeschle & Sons have tested these belts on the roller flour mills of the Hungarian system and found them superior to any belt made in Europe. This was because of their transverse pliability. The machinery which has been sent abroad was specially designed and made by Charles A. Schieren. A set of tools has also been sent to Frankfort, Germany, to John Frank, the German representative, who has secured the order for placing the main belts for the Frankfort Exposition.

The Paillard Non-Magnetic Watch Company, has been organized under the laws of the State of Illinois for the purpose of continuing the manufacture and sale of non-magnetic watches containing Paillard's inventions. The company, in a circular recently issued to the trade says that it has purchased from the manufacturers the movements in process of manufacture at the time of the suspension of the Non-Magnetic Watch Company of America, and has acquired the manufacturing facilities formerly possessed by that company. The movements to be placed upon the market by the Paillard Non-Magnetic Watch Company will be manufactured by the same factories, contain the same inventions and be practically the same as those heretofore sold by the Non-Magnetic Watch Company of America. New grades will be added from time to time as required. Mr. A. C. Smith, formerly with the Non-Magnetic Watch Company of America, will continue as the general selling agent of the new company, and Mr. C. P. Bruch, formerly secretary, is also secretary of the new company. The office of the company is in the Corbin Building, corner of Broadway and John street, New York city.

Mr. F. S. Terry, Manager of the Electrical Supply Company, 171 Randolph street, Chicago, in referring to the state of the copper market, said: "It is not illegitimate speculation that is sending copper to the quarter mark, but the ordinary every day factor of supply and demand. The orders are going in to the mills far faster than they can be filled, and quite naturally the price is advanced the same as though it were an article of food. Yet it is not the mining companies that are reaping all the profit, even though they can lay down their copper in New York at a net cost of from eight to twelve cents, allowing for all expenses; but it is the wise manufacturer o wire and metal goods who, foreseeing the prospective rise in th market price of copper, promptly laid in a supply that will tide him over the present season of high prices. And there is every indication that the price will go higher still." As Mr. Terry has filled his warehouse and two basements with Habirshaw & Shield brand wire, in fact accumulated about a hundred tons before the rise in copper, it is needless to say that he is not worrying over business prospects, which are, however, very good.

Dr. G. B. De Lery, the organizer of the Wenstrom Southern Electric Manufacturing Company, and also of the Wenstrom Northern Electric Company, after having secured all the latest patents of Jonas Wenstrom, of Sweden, for dynamos and motors, has organized the Wenstrom Electric Dynamo and Motor Company, of New Jersey, with offices at 5 and 7 Dey street, New York city. This company held its first meeting July 15, when Dr. J. B. De Lery was unanimously elected president, and Charles S. Cowan secretary and treasurer. The company has purchased 500 acres of land adjoining the celebrated town of Lakewood, N. J., where its engineers are now surveying the land preparatory to building factories for the manufacture of the Wenstrom dynamos, and homes for the factory employés. This company has also undertaken an excellent enterprise in the purchase of the above property which is already of considerable value, and is now negotiating for 1,000 more acres adjoining the tract which they now hold for the purpose of building an electrical city devoted entirely to electrical enterprises. The proprietors will invite electrical manufacturing companies to locate in their town, offering them the very best facilities for the prosecution of their business. This site is directly on the Southern Railroad of New Jersey, between Philadelphia and New York, thus securing splendid facilities for the transportation of freight. The town is a favorite resort in both winter and summer, being located in the southern part of New Jersey, and will no doubt become a great rendezvous for the electrical fraternity. The enterprise is novel, and can be looked forward to as an undoubted success.

Answers to Correspondents.

Questions to be answered in this column must be of general electrical interest. All inquiries must be accompanied by real name and address, as a guarantee of good faith. No notice will be taken of questions regarding apparatus unless enough details are given to permit a definite answer, and no dynamo or motor designing will be done.

Computing the Resistances.—I have an instrument containing three coils, situated as follows: The three join at a common point 0, which is inaccessible, but I know the resistance of 1 + 2 to be 142 ohms; resistance of 2 + 3 to be 55 ohms; 1 + 3, 157 ohms. I wish to know the resistance of coil 1 alone, and I would like also to know the resistance of the other two branches. SUBSCRIBER.

Coil 1, 122 ohms; coil 2, 20 ohms; coil 3, 35 ohms.

Spark Coils.—Would the high self-induction of iron wire, wound for a sparkling coil, balance the disadvantage of its greater resistance? I. J. K.

We do not think you would gain anything by constructing a spark coil as above mentioned. It is worth while noticing that a spark coil requires a considerable study to obtain the dimensions which will give the best results in any particular case. A closed magnetic circuit, for example, does not give as good a spark as an open one, and to obtain the best effect it is generally necessary to experiment quite a little on the proper proportion of iron to copper.

Maintenance of Storage Batteries.—Would you kindly inform me, through the columns of your paper, what the approximate cost would be per year to maintain a storage battery to yield 100 h. p. continuously? J. A. P.

It is quite impossible to give any figures on this subject that you could depend upon, as the life of a storage battery varies enormously according to the care that is taken of it, and the uses to which it is put, to say nothing of difference in construction of battery. A well known foreign firm has recently offered to maintain its batteries for 15 per cent. of their cost per annum, and one of the American companies made a similar offer a year or two ago. Fifteen per cent. strikes us as being a rather low estimate for maintaining the average storage battery.

Power of a Dynamo.—I have a dynamo operated by hand and which develops a current of 10 ampéres of 10 volts. I want to construct an electro-magnet of the solenoid description of armature, constructed like a piston, with a stroke 3 inches, to give 60 strokes per minute. Will you please inform me if the dynamo above described will be capable of lifting by means of such solenoid a weight of 50 lbs. with the speed and stroke above mentioned. If so, what should be the size and dimensions of the solenoid, and would a single or double solenoid be preferable? C. F.

Your machine is not powerful enough to do the work satisfactorily. On general principles, a double solenoid with a U-shaped core would give better results than a single solenoid; but the arrangement is wasteful of power at the best. You would need a much more powerful machine to operate anything like a practical machine constructed on the lines you mention.

Telegraphing from Trains.—Will you tell me how it is that telegraphic messages are received and transmitted on moving railway trains? H. H. M.

The principle involved is the ordinary one of induction of one current upon another. The telegraph line proper has been tried in various positions for effecting this result—close alongside the car or under it, or even on poles at some little distance. A sudden strong current transmitted along this line will produce powerful enough induction in a coil placed in or under the car, as near the line as practicable, to work a relay, or, better yet, to produce a signal in a telephone. This latter method is probably the easiest way of getting the effect, and in such case the signals transmitted need not require the use of strong currents. The method, in brief, is to produce the telegraphic signals by induction from a wire alongside the track, carrying the transmitting current to a circuit on the car containing the receiving instrument.

Platinic Hydrate.—Will you please inform me how platinic hydrate, mentioned in Mr. Wahl's paper, can be made from platinum scrap? H. F. H.

The starting point in the preparation of platinic hydrate is chloroplatinic acid, which is made by dissolving metallic platinum in

aqua regia and evaporating the solution with hydrochloric acid until the nitric acid is removed. The excess of hydrochloric acid is to be driven off and the substance allowed to crystallize. The chloro-platinic acid should then be dissolved in water and precipitated by silver nitrate solution when silver platinic chloride will be formed; while the yellowish red solution free from silver is to be evaporated, preferably over sulphuric acid as a drier, and will then yield crystals of platinic chloride. This platinic chloride is transformed into platinic hydrate in the following manner: To a solution in water add caustic potash, and boil. A double salt will be precipitated, and by heating this with acetic acid to remove the alkali a nearly white precipitate will be obtained which on drying becomes yellow. As Mr. Wahl explained, it dissolves readily in caustics and can be manipulated in the ways he mentioned.

Business Notices.

Steam Pipe and Boiler Coverings.—The H. W. John's Manufacturing Company, 87 Maiden Lane, N. Y., make a specialty of applying their coverings in any part of the United States. Send for estimates.

Through Vestibuled and Colonist Sleepers Between Chicago and Tacoma, Wash., and Portland, Ore.—The Wisconsin Central and Northern Pacific lines run through Pullman vestibuled and colonist sleepers between Chicago and Tacoma, Wash., and Portland, Ore. The train known as the "Pacific Express" leaves the Grand Central Passenger Station, at the corner of Fifth avenue and Harrison street, at 10:45 P. M. daily. For tickets, berths in Pullman or colonist sleepers, etc., apply to Geo. K. Thompson, city passenger and ticket agent, 205 Clark street, or to F. J. Eddy, depot ticket agent, Grand Central Passenger Station, corner Fifth avenue and Harrison street, Chicago, Ill.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

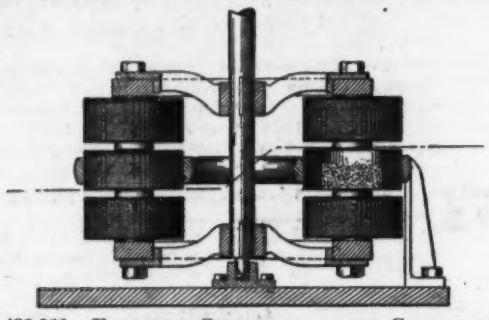
United States Patents Issued July 15, 1890.

432,022. Means for Generation and Conversion of Electric Energy; Angel De Castro, of New York, N. Y., assignor to the De Castro Electric Generator Company, of same place. Application filed July 24, 1889. The combination with a magnetic field, of a loosely inclosed mass of iron filings placed within the influence of such field, and a coil or coils within inductive influence of said mass, and means for changing or varying the magnetic field, whereby the filings are set into vibration.

432,049. Electric Railway; Rudolph M. Hunter, of Philadelphia, Pa., Assignor to the Thomson Houston Electric Co., of Conn. Application filed June 29, 1887. The combination of two railways having their conductor terminals arranged close to each other, one end of the conductors of one railway being looped, so as to come in line with the conductors of the other railway, but electrically disconnected therefrom.

432,050. Induction Coil or Transformer; Carl E. Kammeyer, of Eau Claire, Wis.; Application filed April 1, 1890. In an induction coil or transformer, the combination of a magnetic core built up of iron plates arranged radially around such wire coils, a portion of such plates having their ends bent double upon themselves.

432,053. Electric Meter; Philip H. Korst, of Racine, Wis. Application filed May 27, 1889. In an electric meter the combination of a translating device in the circuit of the current to be measured, said translating device varying in resistance as the current passes through it, and a current reverser, which reverses



No. 432,022.—Electric Generation and Conversion.

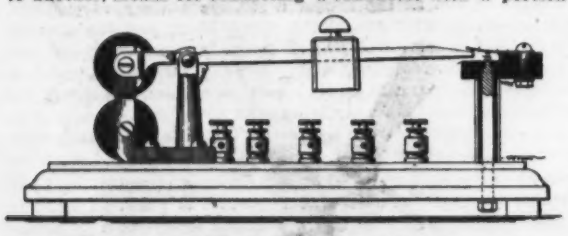
the direction of the current through such translating device responsive to its varying resistance.

432,063. Trolley; William C. Miller, of Albany, N. Y. Application filed April 8, 1890. A trolley provided with a metallic bar having a groove cut at one end, in which the trolley wire passes, said metallic bar being connected to a trolley by means of a bolt passing through a fork of the trolley.

432,095. Electric Railway Switch; William D. Swart, of Boston, Mass. Application filed Nov. 13, 1889. In an electrically operated railway switch, the combination of a permanent magnet pivotally placed beneath the surface of the road bed, with its poles near contact posts, which are electrically connected with two electro-magnets placed on opposite sides of the actuating mechanism of the tongue of the switch, and an electro-magnet secured to the car in such a position as to influence the permanent magnet as the car passes over it.

432,098. Telegraphic Relay; John Martin Treber, of Louisville, Ky. Application filed April 7, 1890. In a relay the combination, with a horizontal single magnet having the upwardly projecting poles, of a lever having its contact point at one end and a yoke at another end, a horizontal single magnet carried by the yoke and having its poles adjacent to the poles of the first mentioned magnet, a main circuit including the said magnets, and a plurality of local circuits operated by the contact end of the lever.

432,131. Current Regulator or Rheostat; Otto Flemming, of Philadelphia, Pa. Application filed March 27, 1890. In a current regulator or rheostat, the combination of a surface of non-conducting material coated with a conducting substance and in which the conductivity decreases from one place upon the surface to another, means for connecting a conductor with a portion of



No. 432,098.—Telegraphic Relay.

the conducting material of greater conducting power, and a movable contact device movable over the contact surface and formed with a series of flexible fingers resting upon said conducting material.

432,136. Electrically Propelled Vehicle; Rudolph M. Hunter, of Philadelphia, Pa. Application filed March 27, 1890. The combination of an electrically propelled vehicle, a source of electric power, an electric motor to propel the vehicle, an alarm or signal carried by the vehicle, a shunt circuit around the motor, including the alarm or signal, and receiving current from the same source as the motor, and a switch to control the action of the alarm or signal independently of the motor.

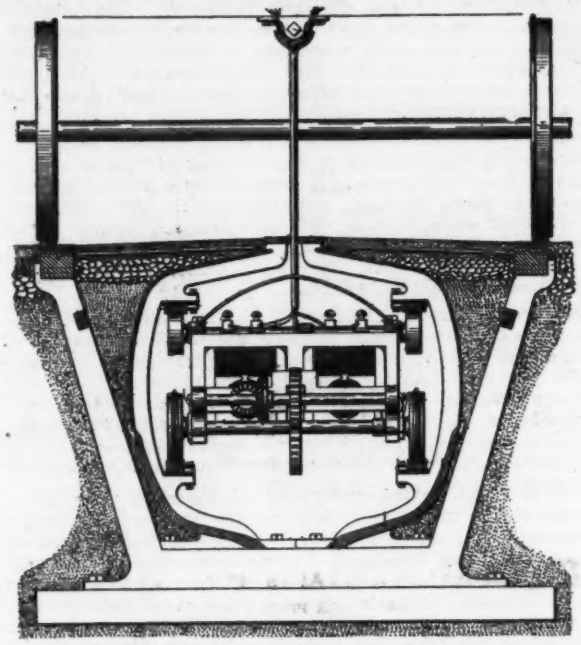
432,142. Electric Locomotive; Walter H. Knight, of New York, N. Y. Application filed February 24, 1885. The invention consists in combining with the driving wheels of an electric locomotive a motor consisting of two oppositely rotating parts which mutually react upon each other and which are mechanically connected to the driving wheels in such manner as to give a coincident rotative tendency thereto.

432,169. Dynamo Electric Machine; Frank A. Perret, of Brooklyn, N. Y. Application filed Feb. 24, 1890. In a ring armature, the combination of the core, the coils thereon, a supporting spider and the two-legged sleeve or boss inserted between the arms of the spider and the end of the core.

432,197. Electric Cigar Lighter; Robert Graham, of Reading, Pa. A lamp comprising a reservoir and a wick having one or more conductors of electricity projecting from the reservoir, combined with a battery, a terminal or electrode independent of the lamp, and connections between the said battery and the wick and terminal, whereby when the wick and terminal are brought in contact an electric circuit is closed, and when they are separated a wick-igniting spark is formed.

432,202. Electrode for Secondary Batteries; James J. McLoughlin, of Philadelphia, Pa. Application filed Dec. 18, 1889. An electrode for secondary batteries consisting of a block of active material mounted in a rectangular supporting frame, having guides formed in three sides and a flap on the fourth side, each flap being formed, to be bent around the lower edge of the active material and thus close the supporting frame.

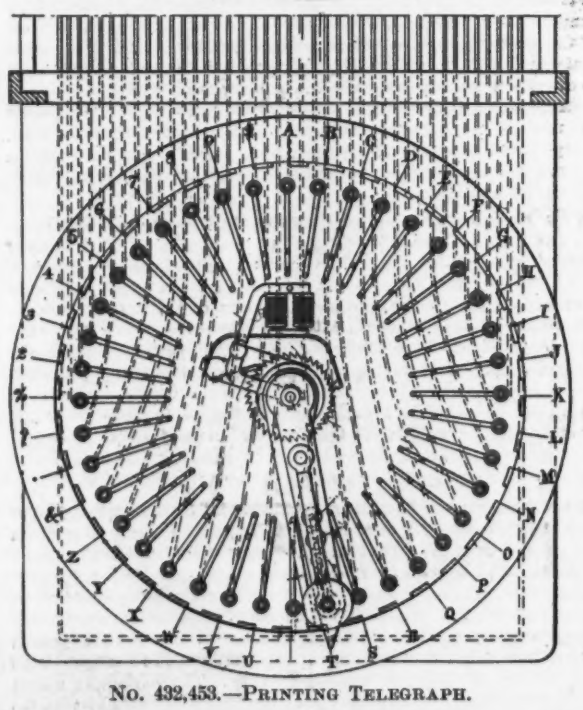
(1) 432,204. Means for Electric Locomotion; (2) 432,205. Electric Heater; (3) 432,206. Commutator Brush; (4) 432,207. Electric Switch; (5) 432,208. Electric Motor Car; (6) 432,209. Electric Clutch; James F. McLaughlin, of Philadelphia, Pa. Application filed (1) Jan. 30, 1890. (2) February 1, 1890. (3) March 19, 1890. (4) April 17, 1890. (5) April 19, 1890. (6) April 26, 1890. An electric railway, consisting of a conduit arranged parallel with the surface track and having contact rails and an electric traction moving thereon, a surface car, and an expanding mechanical connection between the same and the traction car, whereby the required traction friction for the latter is secured. (2) An electric heater consisting of a high resistance conductor embedded in a mass of air tight refractory insulating substance, consisting of a hardened compound of clay,



No. 432,204.—Means for Electric Locomotion.

plaster-of-paris, and asbestos, with suitable circuit connections. (3) A commutator brush for dynamo electric machines, consisting of alternate strips or plates of carbon and metal. (5) In a system of car propulsion, the combination of a motor carried upon the car and a clutch for applying and disconnecting the motive power, with a brake for the car wheels and a single switch mechanism for actuating the clutch and brake, or the brake and clutch in succession. (6) An electro-magnetic clutch composed of two members, one of which is of magnetic material, and both rotating in the same plane concentric with relation to each other, and a series of electro-magnets mounted upon the non-magnetic member so as to be movable into and out of operative relation to the magnetic member and circuit connections.

432,215. Apparatus for Detecting Short Circuits; Harvey Redding, of Everett, Mass. Application filed April 14, 1890. The combination of an electro-magnet included in a main or primary electric circuit, an armature for the electro-magnet



No. 432,453.—Printing Telegraph.

included in a local circuit which is closed by a movement of the armature toward the poles of the electro-magnet, a liquid holding casing inclosing the armature and a body of liquid confined around the armature in the casing whereby the movement of the armature to close the local circuit is retarded.

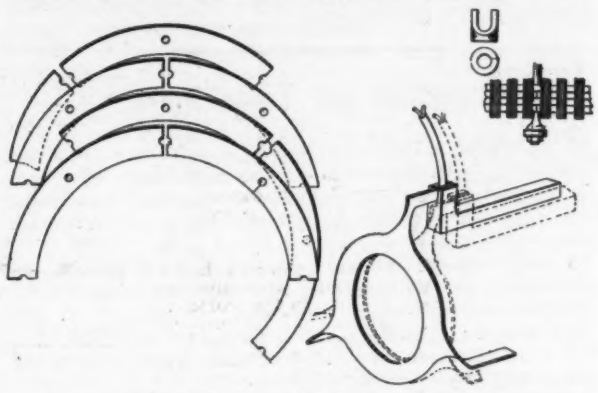
432,234. Electric Switch; Arnold C. Frey, of Wilkinsburg, Pa. Application filed Jan. 16, 1890. The invention consists in a metallic post mounted on a plate of suitable insulating material having attached thereto a three pronged contact piece adapted to be revolved and brought into or out of contact with a pivoted contact, thereby insuring a substantial connection.

432,237. Electrically Propelled Vehicle; John W. Henderson, of Philadelphia, Pa., Assignor to the Electric Car Company of America, of Pennsylvania. Application filed March 28, 1890. In an electrically propelled vehicle, the combination of the two axles, a frame journaled upon one of the axles and connected to the other axle by a bearing having freedom of movement about a verticle axis, and an electric motor supported upon the frame and gearing with the axle to which the said frame is journaled.

432,279. Current Regulator or Rheostat; George Betton Massey, of Philadelphia, Pa., Assignor to Otto Flemming, of same place. Application filed April 2, 1890. In a current regulator or rheostat, the combination of a surface of non-conducting material, provided with a coating of conducting substance which gradually decreases in breadth from one point to another, means to connect a conductor with said coating of conducting substance at the point of its greatest breadth, and a contact piece movable over said conducting surface of a contact face of greater width than the decreasing breadths of the conducting surface, whereby as the contact piece is moved over the conducting surface the area of its contact face in contact with the conducting surface will gradually decrease.

432,310. Regulation of Arc-Light Circuits; Daniel Higham, of Boston, Mass., Assignor to the Higham Parent Right Company, of Rockland, Me. Application filed Nov. 23, 1889. The mode of regulating and stabling arc circuit currents at a constant intensity, said mode consisting, when the current rises above normal in first dropping the potential to check the rise of current and then raising the potential while the current is still above normal, or when a fall of current occurs in first raising the potential but dropping it again while the current is below normal.

432,345. Multiplex Electric Locomotive; Charles J. Van Depoele, of Lynn, Mass. Application filed March 11, 1889. The combination of two axles, two propelling motors journaled upon



No. 432,169.—Dynamo Electric Machine.

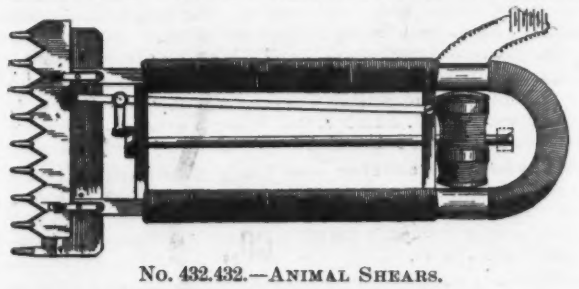
and radially movable upon their respective axles, a stationary longitudinal connection between the motors, and buffer springs upon the stationary longitudinal connection, whereby each motor is flexibly supported with reference to the axle.

432,387. Armature for Dynamo Electric Machines; Oscar Axel Enholm, of New York, N. Y., Assignor by Direct and Mesne Assignments, of one-half to Julius M. Heyman, of same place, and Emmanuel Duret de Brie, of Cognac, France. Application filed November 23, 1889. The invention consists in constructing the armature core of a multitude of discs, plates, or laminæ of soft iron, arranged side by side with interposed non-magnetic gaskets or washers all at right angles to the shaft.

432,416. Conduit for Electric or Cable Railroads; John Lynch, of Washington, D. C. Application filed May 11, 1889. A drainage conduit for electric railways, composed of an electric non-conductor and having projecting supports for the electric conductor for supporting the latter above the conduit.

432,432. Animal Shears; Chester M. Palmer, of Lamartine, Wis. Application filed Jan. 3, 1890. An animal shearing device consisting of a body portion formed of an electro-magnet, the reciprocating cutting devices mounted upon one end thereof, an operating shaft mounted between the arms of the magnet carrying an armature, the electrical current wires disposed about the magnet, and a connection between the shaft and the cutters, whereby the said cutters are reciprocated by the revolution of the shaft.

432,433. Animal Clipper; Chester M. Palmer, of Lamartine, Wis. Application filed January 3, 1890. An animal clipper comprising a case or frame, a cutter, a vibrating bar arranged to



No. 432,432.—Animal Shears.

operate the cutter and provided with an armature, and an electro-magnet or magnets by which to operate such armature bar.

432,453. Printing Telegraph; William W. Taylor, of Mansfield, Mass., Assignor of one-half to Ellen Maria Leavens, of Providence, R. I. Application filed November 23, 1889. The invention relates to improvements in printing telegraphs; and the object of the invention is to provide an apparatus by which type-written messages may be sent by telegraph and recorded at both ends of the line by a person not familiar with telegraphy.

432,490. Manufacture of Carbon Conductors; Achilles De Khotinsky, of Gelnhausen, Prussia, Germany. Application filed Feb. 3, 1890. The process of manufacturing carbon conductors for electric incandescent lamps, which consists in dissolving purified natural cellulose in phosphoric acid of a specific gravity of about 1.70, maintaining the temperature of the acid from 40 to 45 degrees centigrade, forming strips or threads from the solution, separating the cellulose from the phosphoric acid by a liquid capable of precipitating the same from its solution in an amorphous state, such as water and alcohol, and carbonizing the strips or threads.

432,501. Electric Car; Edmund Wageman, of Little Rock, Ark., Assignor of six-sevenths to John D. Adams, Dean Adams, Oscar Davis, J. W. Davis, Horace G. Allis and John B. Jones, of same place. Application filed Oct. 17, 1889. In an electric car, the combination of stationary axles, rotary wheels mounted theron, an armature of an electric motor fixed upon the axles, and field magnets of the motor connecting the wheels and provided with pole pieces which are within inductive proximity to the armature.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1886—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co., Ltd., Times Building, N. Y.